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ART. XX.—ON VERATRUM VIRIDE, WITH EXPERIMENTAL FACTS, TO SERVE AS A CHEMICAL HISTORY OF THE ROOT OF THIS PLANT. By HENRY W. WORTHINGTON.

(*An Inaugural Essay.*)

THERE is no field in nature more inviting to the inquirer than the vegetable kingdom, and in no other department has the laborer been better rewarded, not only from the brilliancy of the discoveries that have been made, but from their beneficial application. The development of proximate vegetable principles may be regarded as constituting a new era in chemical research, and Pharmacy has received an impetus from their introduction, which has hardly been equalled at any period of its history.

Among these proximate principles we find the *alkaloids*, which, from their easy isolation and capability of being rendered subservient to the purposes of the physician, have become, in his hands, a new class of therapeutic agents, as powerful as they are convenient.

Much of the lustre which this branch of science has acquired, is due to the pharmaceutists of France, Germany,

and England, who have extended their researches to many of the indigenous plants of this country. The occupation of this ground, would seem legitimately to appertain to Americans; and may it not be hoped that they will be aroused to exertion by the example of their transatlantic brethren, and even be prompted to manifest some jealousy, when a display of native resources originates elsewhere than at home? Why may not American research add many new and important additions to the already large number of *vegeto-chemical* facts?

The plant which I have chosen as the subject of this essay, having so recently been made the subject of investigation (see *Journal*, vol. ix., p. 181,) by a graduate of the College of Pharmacy, I deem it necessary to state the motives that have induced me to bring it again to notice. The botanical characters and sensible properties of the *American hellebore* being so analogous to those of the *white hellebore* of Europe, have led to the supposition that its medicinal properties were the same, and depended upon the alkaloid which has been detected in the latter. Two analyses have been made, which have been productive of only conjectural results; they did not clearly demonstrate the existence of this principle, although they rendered its presence highly probable; and had the experimentalists been more plentifully supplied with material upon which to operate, it is likely that little would have been left to a successor. With the view of confirming the information that has already been elicited, and, if possible, of rendering it still more complete, at the same time that the correctness of the law will be tested which imposes uniformity of chemical composition upon plants allied by physical resemblances, have the experiments reported in the latter part of this essay been undertaken.

THE BOTANICAL HISTORY.

Veratrum viride. Class, Polygamia; Order, Monœcia, L. Natural Order, Junci, (Juss.) Melanthacæ, R. Brown and Lindley.

Generic characters.—Hermaphrodite, calyx none; corolla six-petaled; stamens six; pistils three; capsules three, many-seeded.

Male. Calyx none; corolla six-petaled; stamens six; pistil a rudiment. (Willdenow.)

Specific characters.—Panicle downy, with the partial bractes longer than their pedicles; segments of the corolla thickened on the inside, at base.

Vulgar names.—Besides American hellebore, this is called swamp hellebore, white hellebore, Indian poke, poke root, and itch weed.

The veratrum viride has a perennial, thick, fleshy root, tunicated at top, the lower part solid, sending off numerous white or light yellowish radicles. The stem is annual, roundish, striated, solid, and pubescent, with the lower part closely invested with sheathing leaves of a bright green color, which are from six inches to a foot in length, broad, oval, nerved, acuminate, and pubescent. The leaves, towards the upper part of the stem, become narrower, and those nearer the summit of the plant serve as bractes, proceeding from the base of the flower stalks. The flowers form a sort of panicle, and are distributed in compound racemes, axillary from the upper leaves, terminal, and of a greenish-yellow color. They are without a calyx. The corolla is divided into six segments green, oval, acute, and nerved, having the alternate ones longer than the other three. Its segments are contracted at base, forming a kind of claw with a thickened or cartilaginous edge. Each flower has six stamens, with recurved filaments, and roundish two-lobed anthers. Germs three, with recurved acute styles as long as the stamens, some of the flowers have

only the rudiments of pistils. Those on the lower part of the stem are fruitful, while those above are barren. The fruit consists of numerous flat imbricated seeds contained in three cohering capsules, which separate at top and open on their inner sides.

It is found growing in many parts of the United States, from Canada to Carolina, inhabiting damp places, and abounds in the neighborhood of small streams, in meadows. It is one of the first harbingers of spring, appearing in the latter part of February, or the middle of March; it sends off numerous broad leaves, which much resemble those of the *Ictodes fœtidus*, but in the course of a few weeks a straight leafy stem is sent up, which rises to the height of from three to five, or six feet. This species of veratrum, as before stated, bears a great resemblance to the *V. album* of Europe, though it is somewhat different, in being of a larger growth, pubescent, and having bractes attached to the footstalk of each flower. Its flowering season is from May to July.

PROPERTIES.

Although the whole plant is acrid and burning to the taste, the root is the officinal portion directed by the United States Pharmacopœia. This consists of a somewhat tunicated top, with a thick fleshy base or caudex, having numerous radicles attached to it, which are sent off from its sides and lower portion. When fresh, the odor is unpleasant, especially if bruised, somewhat resembling that of the skunk. This is lost by drying. The taste is, at first, sweetish, then bitter, followed by an acrid burning sensation in the mouth, which lasts for some hours after it has been chewed. When powdered it acts as a sternutatory when applied to the nose.

MEDICAL PROPERTIES AND HISTORICAL NOTICE.

Under this head much might be said in favor of this article by one whose pursuits were connected with the study of medicines in other besides their chemical and pharmaceutical relations; but as a lengthy medical history would be incompatable with the object in view, I shall make but a few remarks on its more evident properties and uses, and confine myself more particularly to the limits of an analytical essay.

The therapeutic properties of this plant, as established by Drs. OSGOOD (*American Journal of Pharmacy*, vol. vii., p. 202) and WARE—(*Bigelow's Medical Botany*, vol. ii., p. 127–132)—who each instituted a course of experiments on its remedial powers, seems sufficient inducement for its more frequent application by the physician to the cure of disease.

We are informed that the white hellebore was known to, and included in the Materia Medica of the aborigines of this country, and it seems it was known to the Indians more on account of its toxicological properties, than as an agent in the restoration of health, and the purposes for which they employed it seem to entitle it to a prominent place in their catalogue. For an account of the domestic uses to which it is sometimes put, reference can be made to the paper of Dr. OSGOOD.

It has been stated to differ considerably in its medicinal characters from the veratrum of Europe; the latter acting as a hydragogue cathartic, while the American species has not, in any instance, been found to produce such an effect. As an emetic it has been employed by the gentleman before mentioned, whose testimony we have also in favor of its beneficial effects in cases of rheumatism and gout; in which diseases they have used it with much success. When applied externally, in the form of decoction or ointment, its effects are said to be the same on the stomach as when taken internally; and an instance is recorded (*Bigelow's Medical Botany*, vol. ii., p. 135) where a patient was nauseated, and subse-

quently vomited, by an application of the ointment to an ulcerated leg. Wishing to test the properties of an alcoholic extract, made by digesting one ounce of the bruised root in four ounces of absolute alcohol for four days, then filtering and evaporating, I took the fourth of a grain, which caused an acrid burning sensation in the mouth, and communicated to the throat and fauces a sense of dryness and heat, which finally reached the stomach. In the course of about an hour, this dryness and burning sensation in the throat and stomach became intense, and a disposition to hiccough was excited, which soon commenced, gradually increasing in frequency until it reached fifteen or twenty times per minute. This was attended with some sickness and retching, until vomiting took place. This was violent, and seemed to come on about every ten or fifteen minutes for the space of an hour. During this time dizziness and tremor were created, which passed off with the effects of the dose. With the hiccough there was a copious secretion of saliva, and discharge of mucus from the stomach and nose. During the action of this dose, the pulse was weakened so as to be scarcely perceptible, and was reduced from sixty-eight to fifty-two pulsations per minute.

The extract used in this experiment was, as before stated, obtained by evaporating a tincture made by digesting the root in absolute alcohol. With the view of testing whether this had become deteriorated during three weeks, a similar dose was taken which resulted in effects similar to the first. A third dose was taken after several weeks more had elapsed with results the same. In none of these experiments was there any disposition to catharsis.

CHEMICAL HISTORY.

Experiment 1.—An infusion was made by adding an ounce of the bruised root to eight ounces of boiling water, and letting it stand fifteen minutes. After filtration it was of a light brown color, and reddened litmus paper, produced a copious white precipitate with subacetate of lead in solution, a slightly

brown one, which became darker by exposure, with the protosulphate of iron, and a light yellowish-brown one with lime water.

Experiment 2.—A decoction made by boiling an ounce of the bruised root in a pint of water for fifteen minutes, was of a reddish-brown color, had an acid reaction with litmus paper, and was changed to brown by the pure alkalies. From the reaction of the decoction with the sulphur salts of iron, I am led to believe it contains gallic acid in a free state; with alcohol, this also produces a precipitate. On the addition of tincture of iodine, a deep blue color is produced, the well known characteristic of starch.

Experiment 3.—A portion of the root was distilled with water in a retort, until part of the water was driven over. Neither this, nor the water remaining in the retort with the root, possessed the smell of the latter, and that which distilled over was also void of the taste and acrimony peculiar to the root.

Experiment 4.—The tincture made by digesting a portion of the bruised root in diluted alcohol for ninety-six hours, was of a reddish-wine color. This was acid to test paper, formed a yellowish precipitate with lime water, and a copious white one with subacetate of lead. On the addition of the pure alkalies, the color of the tincture was deepened, and the mixture assumed a turbid appearance. With water, the tincture became turbid from the separation of resin. The tincture has a bitter and permanently acrid taste, communicating to the mouth and fauces a sense of burning and dryness. A portion of this tincture was evaporated to the consistence of an extract, which had the sensible properties before described, in a very concentrated degree, though at first sweetish to the taste. This is of a dark color, somewhat resinous, and partially soluble in absolute alcohol, which leaves the gummy matter taken up by the diluted menstruum. It is insoluble in cold ether, and is partially soluble in the fluids of the mouth.

Experiment 5.—An ethereal tincture was made by macerating an ounce of the bruised root in four ounces of sulphuric ether for ninety-six hours, and filtering. This was of a lightish-red or yellowish color, and less acrid and burning than the alcoholic tincture. On the addition of water to a portion of this tincture, its transparency was affected, and after standing a short time, a yellowish oily matter arose to its surface. This substance gave to paper a permanent greasy stain, and on the application of flame it burnt, giving off much sooty vapor. The remainder of the ethereal tincture was evaporated to the consistence of an extract, which was of a blackish-brown color, less acrid than the alcoholic extract.

Experiment 6.—A portion of the root, well bruised, was macerated in water, at a temperature of about 80° Far., for forty-eight hours. This was then strained and filtered, affording a liquor of a pale reddish color, possessing in a diluted state the acrid properties of the root. It was treated with a solution of subacetate of lead, until it ceased to produce a precipitate, and then filtered. Hydrosulphuric acid gas was transmitted through the filtered liquid until it ceased to throw down sulphuret of lead. After again filtering, the liquid was heated to deprive it of the excess of the gas. It was then evaporated to one-half, boiled with magnesia in excess, and thrown on a filter to collect the precipitate. This precipitate was treated with boiling alcohol, and the liquor boiled with animal charcoal to free it from coloring matter. On evaporating to dryness, a light colored powder was obtained which presented the following characters, viz.: nearly insoluble in water, more soluble in ether, and entirely soluble in absolute alcohol. When exposed to flame it first melts, then swells up, and burns without residue. It produces a burning acrid sensation in the mouth, which lasts for several hours. It acts powerfully as a sternutatory, producing violent sneezing, which lasts for a half an hour after it has been applied to the nose,—and, in fact, presents all the physical and sensible characters of veratria. In its chemical relations

this analogy is carried out in not being changed to a red color on the addition of concentrated nitric acid, and from its forming salts with the acids; none of which are crystallizable but the sulphate, tartrate, and oxalate; the two latter partaking of the characters of the acids with which it is combined. All of the salts possess the errhine property of their base.

Experiment 7.—A portion of the root was incinerated, and the ashes treated with boiling water, and the liquor filtered. This was alkaline to reddened litmus paper, and formed a crystalline salt with nitric acid, having the characters of nitrate of potassa. The remaining insoluble portion was treated with boiling muriatic acid, which, when filtered and treated with sulphuric acid, gave evidence of lime by forming a white precipitate.

In reviewing the results of the foregoing experiments, I am led to conclude that the constituents of veratrum viride are, 1. *gum;* 2. *starch;* 3. *sugar;* 4. *bitter extractive;* 5. *fixed oily matter;* 6. *coloring matter;* 7. *gallic acid;* 8. *an alkaloid substance*, identical with veratria; 9. *salts of lime* and *potassa;* to which may be added, *lignin.*

ART. XXI.—OF CHEMICAL SYMBOLS.

By Robert Bridges, M.D.

The constant use which is now made of symbols to express the nature of chemical combinations, in chemical treatises, renders it necessary that they should be understood by all whom interest or inclination may lead to such studies. This journal, during it progress, has contained many papers in which this substitution of signs for words takes place, and it may not be inappropriate, at the present time, to offer to its readers some explanation of this subject. It is to be hoped that those persons who have not acquired this knowledge will not be deterred from giving some attention to it, by the apparently difficult and abstruse nature of the signs; as they may be assured that the difficulty is only in appearance, and the knowledge of symbols can readily be obtained by any who may apply themselves to its acquisition. Moreover, their constant recurrence in chemical essays renders this knowledge of the greatest utility to all who desire to keep pace with the progress of chemistry, even in its more practical parts.

The first point to be understood is the manner in which the elementary bodies are designated. The symbols to express these should be so concise, that, when brought together to denote compounds, the formulæ resulting may not be inconvenient in size, even when the compound signified may be very complicated. To accomplish this object, Berzelius, many years ago, proposed a set of symbols which have since been generally adopted. The elementary bodies are designated on this plan by using the initial letter of the Latin name of the substance, in place of the whole name; and when several names commence with the same letter, to use the initial only for the most common, and to distinguish the others by adding to the initial some succeeding letter, which shall not be common to the rest. The following is the list of symbols of elementary substances, as given by Berzelius.

ELEMENTS.	SYMB.	ELEMENTS.	SYMB.
Aluminium	Al	Mercury (hydrargyrum)	Hg
Antimony (stibium)	Sb	Molybdenum	Mo
Arsenic	As	Nickel	Ni
Barium	Ba	Nitrogen	N
Bismuth	Bi	Osmium	Os
Boron	B	Oxygen	O
Bromine	Br	Palladium	Pd
Cadmium	Cd	Phosphorus	P
Calcium	Ca	Platinum	Pt
Carbon	C	Potassium (kalium)	K
Cerium	Ce	Rhodium	R
Chlorine	Cl	Selenium	Se
Chromium	Cr	Silicon	Si
Cobalt	Co	Silver (argentum)	Ag
Columbium (tantalum)	Ta	Sodium (natrium)	Na
Copper (cuprum)	Cu	Strontium	Sr
Fluorine	F	Sulphur	S
Glucinium	G	Tellurium	Te
Gold (aurum)	Au	Thorium	Th
Hydrogen	H	Tin (stannum)	Sn
Iodine	I	Titanium	Ti
Iridium	Ir	Tungsten (wolfram)	W
Iron (ferrum)	Fe	Vanadium	V
Lead (plumbum)	Pb	Uranium	U
Lithium	L	Yttrium	Y
Magnesium	Mg	Zinc	Z
Manganese	Mn	Zirconium	Zr

To the use of the above symbols there are a few exceptions. Some chemists, instead of K, Na, and Pt, use Po, So, and Pl, for potassium, sodium, and platinum. These are improper deviations from the original plan, and should be avoided as innovations tending to introduce synonymous expressions, and to complicate what is otherwise simple.

These symbols are intended to denote single equivalents of the elementary bodies; thus C expresses one equivalent of carbon; Cl, one equivalent of chlorine; O, one equivalent of oxygen, &c., without the necessity of saying 1C, 1Cl, 1O, &c.; but when more than one equivalent is intended, then a figure indicating the number must be prefixed, as 2C, 3Cl, 4O, for two equivalents of carbon, three of chlorine, and four of oxygen. The manner in which several elements, having the same initial, are distinguished from each other, will be readily

comprehended by reference to those commencing with the letter C in the table.

Several compounds, of frequent occurrence in combination, have received arbitrary symbols, not expressive of the elements entering into their composition. Thus water has been represented by Aq, ammonia by Am, and cyanogen by Cy.

The union of symbols to denote chemical combinations constitutes formulæ. When the union of two or more substances to form one compound is to be represented, the most obvious mode is to unite their symbols by the algebraic sign +, thus Hg+O expresses protoxide of mercury, Hg+S protosulphuret of mercury, &c.

These symbols denoting single equivalents, it is necessary when either or both elements enter into the combination in a different proportion, to express this by the use of numbers in connection with the symbols to be multiplied by them. These numbers are either prefixed to or placed after and a little above the symbol. When the number is placed in the latter position the sign + is omitted, as unnecessary. Thus, periodide of mercury, a combination of one equivalent of mercury with two of iodine, may be represented either by Hg+2I, or HgI^2, and the sesquiodide, consisting of two equivalents of mercury and three of iodine, by 2Hg+3I, or Hg^2I^3.

The extension of this mode of notation to very complicated compounds, would render the formulæ inconveniently long. To avoid this, the sign + is frequently omitted, and the formula thereby rendered more simple. To introduce a still more concise expression, Berzelius has proposed, instead of using in all instances the symbols for oxygen, sulphur, selenium, and tellurium, to substitute for each a particular sign, to be placed over the symbol, representing the body with which they may be respectively combined, the number of these signs denoting the number of equivalents in the combination. Oxygen he represents by a dot (.), sulphur by a comma (,), selenium by a small dash (-), and tellurium by a cross (+). Thus $\dot{H}g$ and $\ddot{H}g$ represent protoxide and deu-

toxide of mercury, $\dot{H}g$ and $\ddot{H}g$, protosulphuret and bisulphuret of mercury, $\bar{C}u$ and $\bar{\bar{C}}u$, protoseleniuret and biseleniuret of copper, and $\dot{\dot{B}}i$ and $\ddot{\dot{B}}i$, prototelluriet and bitelluriet of bismuth.

Two equivalents of the radical are frequently denoted by drawing a line through the lower part of the symbol, but for the convenience of printing, a dash placed beneath the symbol is usually substituted; thus $\underline{As}$ represents two equivalents of arsenic, $\underline{P}$ two of phosphorus, and so on in the case of other symbols. This expression for the doubling of the radical is not to be employed unless in connection with the dot, comma, &c., over the symbol denoting the union with oxygen, sulphur, &c. For example, arsenious acid, consisting of two equivalents of arsenic and three of oxygen, may be represented by $2As+3O$, or As^2O^3, or $\dddot{As}$, but not by $\underline{As}+3O$, or $\underline{AsO^3}$; and sesquisulphuret of antimony, by $2Sb+3S$, or Sb^2S^3, or $\dddot{\underline{Sb}}$, but not by $\underline{Sb}+3S$, or $\underline{SbS^3}$.

When these primary compounds are to be expressed in any multiple of a single equivalent, the manner will vary according to the formula used. Where the elements of the primary compound are united by the sign +, the whole compound is enclosed between parentheses, and the multiple placed outside. But when the more concise mode of notation, which dispenses with the sign +, is adopted, the parentheses are unnecessary; thus the formula for two equivalents of deutoxide of mercury is $2(Hg+2O)$ or $2HgO^2$, or $2\ddot{H}g$, or $\ddot{H}g^2$.

The union of these primary combinations gives rise to more complicated formulæ. The principles on which these are founded are, however, the same as when elementary bodies are concerned, if we consider the elementary formulæ as the expression of a single idea. The object here is not only to express the elements and the number of their equivalents in the compound, but likewise to point out the mode in which these elements and the compounds formed by them are united. To attain this object, the formula of each primary compound,

when expressed in full, is to be enclosed in parentheses, and then connected to its fellow by the sign +. If more than one equivalent of either is concerned, the formula for multiple equivalents, constructed as before noticed, is to be connected by the sign + with the formula of the single equivalent, which latter is enclosed in parentheses; as, for example, protosulphate of mercury, consisting of one equivalent of sulphuric acid and one of protoxide of mercury, is denoted by (Hg+O) +(S+3O), and the bisulphate of the peroxide, composed of two equivalents of sulphuric acid, and one of peroxide of mercury, by (Hg+2O)+2(S+3O.) The sign + between the elements of the primary compound, may be omitted, and the multiplication indicated by the small figure to the right. The notation being thus modified, the parentheses become unnecessary, and the same compounds will then be expressed by $HgO+SO^3$, and HgO^2+2SO^3. Finally, if the dots be used, a still more concise expression is obtained, and these compounds will be denoted by $\dot{H}g+\ddot{\dot{S}}$ and $\ddot{\dot{H}}g+2\ddot{\dot{S}}$.

The formulæ for the more complicated compounds are formed upon the same principles, as will be apparent on examining those of any of the double salts. Thus the following formula expresses alum, a compound of one equivalent of sulphate of potassa and one of tersulphate of alumina, $(KO+SO^3)+Al^2O^3(+3SO^3.)$

In many cases the sign +, as used in the above formula, is dispensed with, and its place supplied by a full point or comma. The formulæ are thus brought into a smaller compass without any further alteration, the effect of these points and the sign being precisely the same. They cannot, however, be used in all cases as substitutes for the +, except in the elementary formulæ. In the more complicated examples, their use is allowable in some part but not in others. This is to be regulated by the mode in which the compounds are united, taking care that the distinction between the several compounds may be clearly pointed out by the use of these signs. Thus, instead of stating the composition of alum as above, this sub-

stitution may be made in the formulæ of the primary compounds; but the + must be retained as a connection between these compounds, and when the formula is thus modified the parentheses are not necessary; thus, $KO.SO^3 + Al^2O^3.3SO^3$.

The figures used to denote the multiplication of the elements or their compounds, differ in their effect according to the position which they may occupy in the formula, and have sometimes an intimate relation with the sign + or its substitutes. A number in a formula on a level with the line, multiplies all the symbols that follow to the first sign + or full stop which occurs; or if these do not occur, its force continues to the end of the formula. The only exception is, when the number is prefixed to formulæ enclosed in parentheses; the whole thus enclosed is then affected by it. But when it is placed after and at the top of the symbol, the effect is different. The element immediately preceding is alone multiplied, when all the elements are expressed by symbols; but when the doubling of the radical or the equivalents of oxygen, &c., are denoted by signs, then the whole formula is under its influence, the effect being the same as if the number had been prefixed; thus $2\dot{\dot{F}}e$ and $\dot{\dot{F}}e^2$, each denote two equivalents of sesquioxide of iron.

As the principles derived from the animal and vegetable kingdoms, when resolved into their ultimate constituents, are found to consist of from two to four elements united in different proportions, it becomes burthensome to the memory to recollect, and inconvenient in practice to express by regular formulæ, the varied composition of these substances. Some concise mode of denoting the compounds is, therefore, desirable. So far as organic acids are concerned, Berzelius designates them by arbitrary symbols formed from the initial letter of the acids, in the same way as the symbols of the elementary bodies are formed, and, to distinguish them, places a dash over the symbol; thus acetic acid is expressed by $\overline{A}$, instead of the formula $C^4H^3O^3$; benzoic acid by $\overline{B}$, instead of $C^{14}H^5O^3$; citric acid by $\overline{C}$, instead of $C^4H^5O^4$, &c.

The plan of arbitrary symbols to express other organic bodies might be still farther carried out, but has not at present been adopted to any extent. Some other products of organic matter have, however, been thus designated, of which Bz for benzule is a case in point.

Some modifications in the mode of stating formulæ have been suggested by LIEBIG and POGGENDORF, and adopted in the edition of Turner's Chemistry, now in course of publication in London, under the superintendence of Professor LIEBIG and WILTON G. TURNER, brother of the deceased author. Instead of placing the number after the symbol at the top, it is brought down partly below the line, thus sulphuric acid is represented by SO_3 instead of SO^3. This modification would be productive of little or no embarrassment to those who are well acquainted with the use of symbols, but to the learner it would be otherwise.—Many are deterred from attempting to obtain a knowledge of symbols by the apparent difficulty of the subject, and this would have a similar tendency by the introduction of synonymous symbols, and additional variety in the modes of expression. This change may prevent, in those conversant with mathematics, the confusion arising from the numbers being in the same position as the indices of the powers in algebra; but this would hardly compensate for the difficulties which beginners would find in the increased variety of notation. Another proposition of LIEBIG and POGGENDORF, well deserving of attention, relates to the different symbols for water: Aq, HO, and $\dot{H}$. They restrict the use of Aq to denote water of crystallization, and propose to introduce another symbol to express combined water, as in the hydrates, viz.: a small *h* placed after the symbol and a little below the line. Thus, hydrate of potassa would be represented by $\dot{K}_h$. The other symbols HO and $\dot{H}$, they propose to use in doubtful cases, or when chemical changes are to be explained. An illustration may be taken from malic acid. This acid carries with it into combination one equivalent of water. Crystallized malate of magnesia consists of one equivalent of malic acid,

one of magnesia, and five of water, four of which constitute water of crystallization, and the fifth combined water. To express this by the above mode, the following formula is used, $MgO,\overline{M}_h+4Aq.$

ART. XXII.—MEDICO-BOTANICAL NOTICES. No. XIV.

Indian Senna.—Under the name of *Cassia lanceolata* is described by Dr. WALLICH, in the eighth volume of the Transactions of the Medical and Physical Society of Calcutta, the plant which affords this common article of merchandise. This appellation was first employed by FORSKALL to designate the acute-leaved variety of senna in contra-distinction to the obtuse-leaved, and has been supposed by able botanists to refer to one of the species entering into the composition of Alexandrian senna. This was the opinion of LAMARCK and subsequently of DECANDOLLE, as both of them refer the species to Egypt, when speaking of it. DECANDOLLE, in fact, correctly blends together this species and the *C. acutifolia* of DELILE. NECTOUX adopted the name of *C. lanceolata* when treating of the Egyptian species, and undoubted evidence is presented in his memoir, and that of DELILE, that they both referred to the same plant, to the exclusion of that yielding Mocha or Indian senna. Dr. WALLICH, whatever may be the merit of his description, which coincides with that of FEE, (see *Journal of Pharmacy*, vol. iii., p. 226,) has been unfortunate in the name adopted by him, and in his citation of European botanists; all of whom have drawn a distinction between the plant affording a portion of the Alexandrian drug and that yielding the Indian article. He certainly could never have seen the description of this last under the name of *C. elongata*, LEMAIRE, or he would not

have fallen into the error of confounding the histories of the Egyptian and Indian sennas.

From this memoir, we learn that the plant is not a native of Hindustan, but was introduced into the botanic garden at Calcutta in the year 1800, by Dr. CAREY; it appears at that time not to have thriven, and was lost. About eight years from the date of the memoir, (September, 1834,) Dr. WALLICH succeeded in raising a number of plants from seeds found in pods among a batch of senna which had recently arrived from Arabia. He gives the following account of his success: "Some difficulties were experienced at the commencement in preserving the plants and making them produce good seeds, but they were gradually surmounted, and we have, at this time, August, 1834, several plots of land in cultivation with the species; the greatest proportion of the plants being in a healthy and vigorous condition, full of flowers, and showing successive crops of ripe pods. The unusual degree of heat, during the late dry season, sensibly affected some of the individuals, by causing a disease in the root which killed them during the rains. Still our crop is far better than I had any ground for anticipating; a good quantity of seed has already been obtained, and a further supply remains still to be reaped, which will enable us to raise a much larger proportion of plants next year. The mode of cultivation which has been found to answer best, is to transplant the seedlings after they have acquired a height of about six inches, at a distance from each other of three feet, in slightly raised beds, or patches of open ground, previously well cleansed from weeds and enriched by the addition of some vegetable mould. We sow the seed in the month of December; germination commences in almost twelve days, and the transplanting takes place in February, after which the plants grow luxuriantly, provided they are watered during the hottest days of April and May. Upon the whole, it has been found that shading of any kind does more harm than good; and although a number of the young plants perish in their

tender age from the excessive heat, yet by constantly supplying their place with fresh seedlings, no sensible loss has occurred in the end from that source. The plants begin to blossom in April, and they continue producing successive crops of flowers and fruit until the cold weather begins to make its first appearance early in October, soon after which the plants die away, very few individuals surviving a second year."

Rhubarb.—Through the labors of Mr. ROYLE, we are possessed of the following information with respect to the article above named, (*Royle's Botany, &c., of the Himalayas and Cashmere:**)

"The *Rheum Rhaponticum* is found in several parts of Russia, on the shores of the Bosphorus and Caspian Sea, eastwards in Siberia, and the lower mountains of the Altai Range; *R. Sibericum* and *undulatum* of PALLAS, are considered by LEDEBOUR to be only varieties of this. *R. leucorhizum*, (*nanum Sievers*,) is also found in the Altai mountains, and the deserts of the Kirghis. Neither of these afford the rhubarb of commerce, which is not found within the Russian territories, but well known to be brought by the Chinese to the Russian frontier town of Kïakhta, according to the treaty formed between these powers in 1772. The Chinese obtain the rhubarb produced in China proper, from that part of the province of Shensee now called Kansu, situated between N. lat. 35° and 40°. But the best, according to the Missionaries, who say it is called Tai-hoang, is procured in the province of Setchuen, from the mountains called Sue-chan, or of Snow, which extend from N. lat. 26° to 33°, and from about 100° to 105°, of E. longitude. That from the latter province probably forms much of what is called China rhubarb; the Missionaries met large quantities of it brought down in the months of October and November. That from Kansu may afford some of what is called Russian rhubarb;

* *Madras Journal of Literature and Science*, No. 13, Oct. 1836.

but both PALLAS and REHMAN have ascertained that the greater portion, if not the whole of this, is obtained in April and May, from the clefts of rocks in high and arid mountains surrounding lake Kokonoe."

From the distribution of rhubarb in the Himalayas, Mr. ROYLE seems to think that it would be a profitable undertaking to introduce the true plant within the British Indian possessions; as for instance, in Kanawur or the Bhoteah pergunnahs of Kemaon, where the soil and climate would be favorable to it, thus avoiding the immense distance that it has now to be carried. The species growing in the Himalayas, are the *Rheum ribes* (ribas of the Persians,) *R. Moorcroftianum*, *R. Emodi*, and *R. spiciforme*. The only difficulty in the way of the enterprise proposed by Mr. ROYLE, is that of obtaining either seeds or roots.

J. C.

ART. XXIII.—NOTICE OF THE OBSERVATIONS OF BERZELIUS, L. THOMPSON, AND M. VOGEL DE MUNICH UPON THE PROCESS OF JAMES MARSH FOR THE DETECTION OF ARSENIC.

WE again call the attention of our readers to the process of JAMES MARSH for the detection of arsenic, for the purpose of recording additional information, and to point out other sources of error, and the means by which they may be avoided. BERZELIUS, in some observations upon several modes of detecting arsenic, (*Journal de Pharmacie*,) after giving an outline of this process, proceeds to remark: "MARSH has contrived a very convenient apparatus for this purpose, but he has employed the gas by no means well. In fact, he allows it to escape by a small opening, he inflames it, and then places in the flame a plate of glass, which becomes covered with metallic arsenic, or else he directs the flame into a narrow tube,

open at both extremities, in which metallic arsenic and arsenious acid are deposited."

"MARSH has in this neglected a property of the gas, which may with great certainty be turned to good account, viz.: that of depositing the arsenic by heat; it is only necessary to pass the gas through a tube heated to redness in one part; the arseniuretted hydrogen is then decomposed into arsenic, which is deposited further on in a cool part of the tube, and into hydrogen which is disengaged in a pure state. For this purpose, there is need of no other apparatus than a flask for the disengagement of the gas, a pipe to conduct the gas, as soon as disengaged, through a glass tube heated to redness in one part by the flame of a spirit lamp. If we wish, for greater certainty, to place in the red part of the tube a small quantity of a known weight of copper reduced by hydrogen, a white arseniuret of copper will be obtained, and we may thence ascertain with great exactness the weight of the arsenic which accompanies the hydrogen.

"I dissolved a millegramme of white arsenic in a little diluted sulphuric acid; I then added to the solution six ounces of water and some zinc; I passed the hydrogen thus obtained, upon a known weight of copper previously reduced by hydrogen, heated to redness in a narrow glass tube.

"The presence of arsenic was very evident; the anterior part of the copper became silver white, and heated in a lamp gave out a strong odor of arsenic.

"Having operated with one centigramme of arsenic, I obtained two-thirds of the arsenic which it contained, combined with the copper. It results that this process, although not applicable to a quantitive analysis, deserves all our attention as an analysis well suited to all cases of legal medicine."

This testimony of BERZELIUS tends to increase our confidence in the process under consideration, while at the same time it points out an improvement in the mode of manipulation. On the other hand, a late discovery of Mr. L. THOMPSON, shows that this method might lead to very erroneous

conclusions, unless we are acquainted with all the sources from which error may arise. The discovery alluded to above is a "hitherto unnoticed combination of antimony and hydrogen," which he denominates "antimoniuretted hydrogen." This gas was procured by acting upon an alloy of equal parts of antimony and zinc with dilute sulphuric acid. It presents the following properties:

"Antimoniuretted hydrogen (*Lond. and Edin. Phil. Mag.* May, 1837,) is a colorless inflammable gas, exploding violently by the electric spark or lighted taper when mixed with an equal volume of oxygen, chlorine, or atmospheric air; its odor is peculiar, and approaches nearly to that of arseniuretted hydrogen; inflamed at a jet in the open air, it burns with a pale, bluish green flame, resembling that of arseniuretted hydrogen, and gives off a dense white volatile vapor, which collects as a semi-crystalline oxide on cold bodies placed over it, affording another instance of the similarity of these gases; when a piece of cold glass or china is held in the flame, a metallic crust is deposited, and when a tube of glass is used, the metallic film is formed on that part of the tube nearest the flame, and the white oxide around and above it. It is unnecessary to add, that these appearances coincide in a very remarkable manner with those produced by arseniuretted hydrogen under similar circumstances, and although a practised eye may discern some difference between the crusts, that from antimony being more silvery and metallic, yet the line of demarcation is not easily drawn, for a thin film of antimony looks more like arsenic than antimony, and a thick crust of arsenic has the metallic appearance of antimony. When sulphuretted hydrogen is passed over the oxides of these metals, the antimonial oxide will become of a darker yellow than the arsenical; but this is also fallacious, for a small quantity of antimony gives a yellow tint not darker than orpiment, and if any metallic arsenic be present in the arsenical oxide, a portion of realgar forms and gives the product an orange hue. The ammoniaco-sulphate of copper is liable to similar objections; for

a large quantity of the oxide of antimony produces a whitish green precipitate, which might easily be mistaken for Scheeles green. The two metals may, however, be distinguished by adding a drop of nitric acid to the crusts; they will immediately dissolve, and on evaporating to dryness, a white powder is left in each instance. A few drops of dilute solution of the nitrate of silver being now added, and the whole exposed to the fumes arising from a stopper moistened with ammonia, the antimonial solution will be observed to deposit a dense white precipitate, whereas that from arsenic will give the well known canary-yellow flocculi."

The antimoniated hydrogen, when inflamed, yields results equal in delicacy to those produced by arseniuretted hydrogen; for "the gas arising from one grain of tartar emetic, or any other salt or oxide of antimony with a little diluted sulphuric acid and zinc, will furnish abundance of metallic crusts; indeed, a single drop of the common wine of antimony will produce a distinct film."

Considering the liability of tartarized antimony being administered to produce vomiting either in cases where poison has been taken or is suspected, the above discovery becomes of great interest, and it is important for us to know the different habitudes of these gases to be enabled to discriminate between them with greater certainty. The following observations of M. Vogel de Munich, (*Journal de Pharmacie*, Mars, 1838,) will afford considerable aid on this point:

"When we direct the flame of this gas (antimoniuretted hydrogen) upon a plate of porcelain, this becomes covered with metallic films, in the same way as with arseniuretted hydrogen; but if we burn the antimoniuretted hydrogen in a bell-glass in contact with the air, not the smallest trace of antimony is deposited upon the sides of the vessel, a circumstance which happens in a very decisive manner with arseniuretted hydrogen; although the quantity of arsenic may be very small in a large quantity of hydrogen, the deposit of arsenic will yet be very sensible. Chlorine gas mixed with

antimoniuretted hydrogen, does not set free the metallic antimony, it only forms a small quantity of chloride of antimony, which may be recognised by means of sulphuretted hydrogen. Arseniuretted hydrogen, on the contrary, into which a few bubbles of chlorine has been passed, deposits much metallic arsenic, which attaches itself to the sides of the vessel; and the appearance of a black film is very sensible, even when arseniuretted hydrogen is mixed with forty or fifty times its bulk of pure hydrogen gas. Chlorine offers, therefore, much greater security in detecting traces of arseniuretted hydrogen, when mixed with a large quantity of pure hydrogen, than the combustion of this mixture in the air, although it then deposits a small quantity of metallic arsenic. When arseniuretted hydrogen is mixed with so much air as to be no longer inflammable, we may even then separate the arsenic in a metallic state by a bubble of chlorine. In all these cases it is necessary that the chlorine should be added to these gaseous mixtures in very small quantities, for without this precaution the metallic film will either not appear, or will disappear immediately after."

M. Vogel then proceeds to prove that the hydrogen obtained, when a salt or oxide of antimony has been used, contains more of the metal than that from the alloy. He likewise differs from Mr. Thompson with regard to the difficulty of discriminating the results produced by the combustion of these different gases; for after stating the assertion of Mr. Thompson, he remarks:

"I do not see the necessity of taking these pains, neither do I partake in the fears of Mr. Thompson, that sulphuretted hydrogen will give rise to error, and cause antimony to be confounded with arsenic. It appears to me more simple to arrive at the same end in the following manner: add to the two films of arsenic and of antimony a single drop of aqua regia, composed of two parts of concentrated hydrochloric and one of nitric acid; this acid will dissolve these films without heat; moisten these spots with several drops of water well charged with

sulphuretted hydrogen, this will produce with the arsenic a pulverulent deposit of a golden-yellow, and with the antimony an orange-yellow precipitate; the first disappears on the addition of some drops of ammonia, which is not the case with the other."

From this he concludes,

"1. That arseniuretted hydrogen may easily be distinguished from antimoniuretted hydrogen, and that the former, whether mixed with a large quantity of hydrogen or of air, is decomposed by chlorine so as to produce metallic films, which is not the case with antimoniuretted hydrogen.

"2. Finally, that the films formed upon the porcelain by the combustion of arseniuretted or antimoniuretted hydrogen, when dissolved in aqua regia, can be distinguished, without fear of error, by means of sulphuretted hydrogen."

R. B.

SELECTED ARTICLES.

ART. XXIV.—REPORT OF THE ROYAL COLLEGE OF PHYSICIANS OF EDINBURGH ON THE ADULTERATION OF DRUGS.

Edinburgh, 2d March, 1838.

At an Extraordinary Meeting of the Royal College of Physicians held this day, to consider a Report from a Committee of its Fellows respecting the Adulteration of Drugs, the following Resolutions were agreed to:

1. That the College approve of this Report, and adopt it, and direct it to be published in terms of the recommendation of the Committee.

2. That the thanks of the College be given to Dr. Christison, Secretary to the Committee, for the very great trouble he has taken in collecting the information on which the Report is founded.

(Signed) in name of the College,
W. P. Alison, *President.*

Report of the Pharmacopœia Committee of the Royal College of Physicians on the Adulteration of Drugs, 24th January, 1838. At a meeting of the Committee held this day for considering finally a remit from the College to inquire and report respecting the extent of the adulteration of drugs, and the means of abating the practice,—Present Dr. Alison, President, and Drs. Davidson, Abercrombie, Graham, Poole, Traill, Ransford, and Christison,—it was resolved, after careful deliberation, to report as follows:

1. That the adulteration of drugs is undoubtedly carried

on at present to a great extent, and affects more or less a great proportion of the most important articles of the Materia Medica.

2. That while these adulterations may be presumed to be practised in a variety of quarters,—by the foreign producer, foreign merchant, wholesale druggist, chemical manufacturer, and retailer,—some of the more obvious or discoverable sources of the evil are the inadequate education of retail druggists, especially in practical chemistry,—the want of an authorized system of simple tests for ascertaining the purity of drugs,—the want of any check for preventing adulterations,—and the necessity, real or supposed, for lowering the prices, and of consequence the quality of drugs, in order to meet the unreasonable demands of the public.

3. That the practice of adulterating drugs will be probably diminished by the College of Physicians adding to the Pharmacopœia, as it has resolved on doing, a list of simple characters for the articles of the Materia Medica, by means of which they may be ascertained to be of the requisite degree of purity for medicinal use, and free from certain known adulterations.

4. That, while this system may prove very efficacious by furnishing retail druggists with the means of detecting adulterations practised elsewhere, and thus of securing their own true interests, it is highly desirable that the education of persons intended for this profession should be elevated, as well as regulated and ascertained by some competent authority; and that in this way important benefits would be conferred on the profession itself, on medical practice, and on the public generally.

5. That the adulteration of drugs, provided the two previous measures were enforced, might be in a great degree put an end to by a methodical system of visitation of public shops; which, notwithstanding some failures in this country, your Committee are inclined to think may be rendered efficient under certain conditions, and more especially if conducted

mainly by an organized and well educated body of druggists themselves.

6. That advantage would also be derived from stated authoritative advertisements of the wholesale prices of genuine drugs, and authoritative announcements of newly discovered adulterations.

7. That although your Committee do not think it their duty at present to suggest any specific means for carrying the above mentioned measures into effect, they would strongly recommend that the state of the case be made generally known by the authority of the College, and for this end that the College shall publish this Report, together with an Appendix consisting of detailed observations on the subject, which have been communicated to your Committee by their Secretary, and are lodged herewith.

8. That the proceedings of the College be communicated to the Royal College of Surgeons, with the view of ascertaining whether, and in what way, the two bodies may co-operate in carrying into effect any resolutions that on careful inquiry may seem to them advisable.

In name of the Committee,

R. C. *Sec.*

APPENDIX.

OBSERVATIONS ON THE ADULTERATION OF DRUGS.

BY DR. CHRISTISON.

It is well known to every one practically conversant with pharmacy, that the adulteration of drugs is at present practised in Britain to a most injurious extent, and a general feeling prevails that it has been for some years past upon the increase. Whether this impression be correct or not, there can be no doubt of the extreme frequency of the practice. It may be safely averred as the result of the best inquiries on the subject, that few medicines in general use escape occasional sophistication; that some are scarcely ever pure; that the impu-

rities are frequently so great, as to render the articles nearly or entirely inefficacious; and that medicines of this kind are to be found occasionally in the shops even of the most respectable druggists, and notwithstanding great pains on their part to obtain and dispense nothing but what is genuine.

For some years past the attention of the College of Physicians of Edinburgh, in some measure the guardians of the public in this matter, has been pointedly turned to an evil so serious, and so disgraceful to the present improved state of pharmacy. The College of Surgeons of this city have also been led more recently to inquire into the subject; and have appointed a committee to examine into the extent of the practice, and the means of abating it. A short time ago the former College was requested to co-operate with its sister institution, and the two bodies have resolved to join in the investigation. It cannot be doubted that they will proceed cordially in the task they have thus laid down for themselves; and it may be confidently anticipated that their labors will not terminate without some important practical results. It is to accelerate their operations, by making the existing state of the question generally known, so far as my inquiries have hitherto gone, that the following observations have been drawn up.

I believe I shall be most likely to attain the object in view, by treating the subject under the three subsequent heads. It will be right, in the first place, to show, from actual examples, that the adulteration of drugs is practised to an extent injurious to the success of medical practice, and in a way which defies the caution even of well informed and conscientious druggists. An attempt will next be made to point out the sources of these adulterations, that is, the quarters where the practice is carried on, together with the circumstances in the commercial history of drugs which seem to have led to it. And lastly, a sketch will be given,—but with due diffidence on a subject of such intricacy, and surrounded by so many diffi-

culties,—of those measures which appear practicable, and most likely to diminish the evil.

I. Under the first of these heads, it might perhaps be sufficient to refer to the general conviction of the profession, or to what has been written on the adulteration of medicines in various excellent works on Materia Medica and Pharmacy. But it will bring the matter more home to the minds of all, if some details be entered into, consisting of a few facts which have chiefly occurred to my own observation, and among which are some, not unimportant, yet either unknown, or but little attended to in any pharmaceutic works. With this view is subjoined the following list of adulterations, which could be easily extended, were it necessary.

1. A few years ago I directed the attention of medical men to the frequency of the adulteration of *iodide of potassium* with carbonate of potash. A faint contamination of this nature is exceedingly common, because it can with difficulty be avoided in the manufacture of the salt; but impurity from this cause is of little consequence to medical practice, because it never exceeds one, two, or at the utmost five per cent. Not unfrequently, however, it amounts to ten per cent. or upwards, for which carelessness is the lightest excuse that can be found; and I have examined specimens, at one time very generally to be met with in this country, where the carbonate with its accompanying water amounted to ninety parts in the hundred,—which, it need scarcely be said, was an express sophistication. Can we wonder, then, that practitioners should complain of the iodide of potassium, that they have given it for months, nay even for years, without observing any effect either on the constitution, or on the disease for which it was administered? Another adulteration is with muriate of soda or potash. Some have considered this to be a frequent impurity.

But I have not met with it so often as the other, and it has appeared to me always less in amount, seldom surpassing

ten per cent. It is an intentional adulteration; at least there is no circumstance in the processes for preparing iodide of potassium which can lead to its accidental introduction, except in small quantity.

2. *Iodine* itself is another instance. Various impregnations of iodine have been indicated by authors, such as with oxide of manganese, brick dust, and other substances of a fixed nature; which, however, I have never met with throughout a long train of investigations. But there is another impurity, at present seldom wanting in British iodine, and which has not yet been publicly noticed. This is with water. It is probably not very easy to prevent a certain impregnation with water. But nothing except gross carelessness or fraud will account for the presence of fifteen per cent., which I have separated, or for twenty per cent., which I am informed by M. Robiquet of Paris is not unfrequently found in the British iodine imported into France. Perhaps this amount of impurity is not of very material consequence to medical practice, the variation of the dose by a fifth part being probably not so important as many would have us think. The admixture, however, is not the less a fraud,—a fraud, I may add, which, according to M. Robiquet, has of late greatly reduced the demand in France for iodine of British manufacture.

3. Another good example is the spirit of *nitric ether*, a medicine of much value, and in most extensive use. I have not myself made any experiments upon its adulterations. But the subject may be equally well illustrated from the evidence delivered in 1834, by Mr. Cooper, lecturer on chemistry in London, before the Medical Education Committee of the House of Commons. Mr. Cooper, while travelling between Bath and London, happened to call for an acquaintance, a chemist and a druggist in one of the intermediate towns. During his visit, the travelling member of a wholesale house in London called in pursuit of his occupation, and among other things offered for sale the spirit of nitric ether. His customer asked him its price, to which he replied that he had it of

three prices: 2*s.*, 3*s.* 6*d.*, and 4*s.* 6*d.* a pound. The retailer ordered the article of the second quality. This drug is subject to a certain variety, because it is not a regular and definite compound, but a mere mixture of rectified spirit and nitric ether. Certain differences must exist, according as it is prepared by the process of the Edinburgh, the London, or the Dublin Pharmacopœias. But it need scarcely be said that no such differences will account for so extravagant a variety of price, as that mentioned by Mr. Cooper, and that the two inferior qualities of the drug must have been adulterated, probably with rectified spirit, or the cheaper addition of water.

4. A most important set of adulterations are those practised upon substances of very great energy, and which are given in minute doses. For here it is not merely a fraud that the public must submit to; life itself may in consequence be brought into danger. Of this, *hydrocyanic acid* is an excellent example. The profession are generally aware of the extreme uncertainty of the strength of this formidable medicine. The fact has been often brought experimentally under my notice; but I prefer at present to quote some recent observations made by Dr. Fyfe, and presented by him in a report to the committee on adulterations appointed by the College of Surgeons.

Few medicines perhaps are subject to so many sources of variation as hydrocyanic acid. It is prepared by different processes, which are calculated to yield it of various strengths. Variations arise even where the same process is followed, according as the rapidity of the distillation varies, or the temperature of the refrigerator. It loses some of its acid unless carefully preserved. And a further diminution invariably occurs in the shop of the druggist, as the contents of a bottle are gradually dispensed. For one, or another, or all of these reasons, the proportion of real acid differs exceedingly. Among samples obtained in shops of great respectability, Dr. Fyfe found some that contained four times as much as others. Serious accidents might in consequence ensue in medical practice. This medicine is variable in its effects in different

constitutions; and, therefore the physician must always begin with a very small dose, and gradually increase it till the effect he desires be obtained. Now, suppose he has begun with the weakest acid of the shops, that he has brought up the dose, as may well happen, to ten, fifteen, or even twenty drops, and that then, the store of this sample being exhausted, the druggist betakes himself to an article, which, unknown to him, is of four times the strength. What is likely to be the result? The death of the patient would be not improbable.

5. Let me add another instance of the like kind. The active principle of nux-vomica, *strychnia*, now currently employed as a remedy in the chronic forms and stage of paralytic affections, is very little inferior in energy as a poison to hydrocyanic acid. In the shops it is scarcely ever met with pure; because even the impure article bears a very high price, and because its complete purification, besides being troublesome, and probably unnecessary in respect of its excessive energy, cannot be accomplished except at such loss as would raise its value from fifty shillings to five or six guineas an ounce. The article of the shops always contains a large proportion of another alkaloid, brucia, whose effects on the animal body are precisely the same in kind, but much inferior in degree. This impregnation is probably advantageous rather than the reverse; because by diluting a drug of such tremendous activity as strychnia, it is rendered more manageable in medical practice. But another impurity, of great consequence in a medicinal point of view, is inert coloring matter. The proportion of this varies much, some specimens having a dark brown color, others a light grayish brown, and some being very nearly colorless. It is almost unnecessary to point out the serious consequences which may ensue from such irregularities in the strength of so potent a medicine. The danger is the greater, that, in order to do any good in palsy, it must be given in such quantity as to excite a certain degree of its physiological or poisonous influence. An accident which happened not long ago in my own practice will sufficiently

illustrate what is here stated. A man affected with palsy took every evening gradually increasing doses of a strychnia less pure than the average, till at length one evening the dose was directed to be increased from two-thirds to three-fourths of a grain in two pills. At the same time the sample of the medicine supplied by the apothecary was changed for one almost of snowy whiteness, and consequently far purer. Through some lucky whim the patient took only one pill. In the night time he was attacked with violent tetanic convulsions, protracted spasms of the extremities, severe locked-jaw, violent opisthotonos, spasmodic fixing of the chest, and all the other formidable symptoms of poisoning with this alkaloid; in which state he continued for several hours. From all we know of the effects of strychnia, there can be little doubt that had he taken both pills the issue would have been fatal.

6. Apt illustrations may also be taken from vegetable drugs of a compound nature, into which impurities may be introduced accidentally, or by design, more easily perhaps than into any other description of medicines, and where also the detection of them is sometimes exceedingly difficult. Under this head I shall take as examples three of the most familiar and most valuable articles of the Materia Medica, namely, gamboge, scammony, and opium. *Gamboge* is one of those purgatives, to which some physicians entertain a dislike on account of its supposed irregularity and violence of action. But this notion has always appeared to me founded on prejudice; for after extensive trial of it, often without any adjunct except inert powders to facilitate fine division, it has appeared to me equally manageable, safe, and uniform in effect, with any other active cathartic. Various causes may be assigned for its occasional irregularity of action. Whether its sophistication is one cause, I know not; but the frequency and extent of the adulterations of gamboge are sufficient to account for the variations complained of. I have been led to pay particular attention to this subject,—which, by the way, is

not noticed in any work on pharmacy I have seen,—in consequence of having lately made a detailed inquiry into the sources and composition of the different kinds of gamboge, which has been published in the Companion to the Botanical Magazine. Three kinds of the drug are known in the English market, which all come from Siam by way of Singapore, namely, pipe, lump, and coarse gamboge. The first is perfectly pure, consisting of resin, gum, and a little moisture; and the resin, its active part, amounts on an average to seventy-three per cent. The two others, which a person of skill can easily distinguish in mass, but not so easily in powder, are invariably adulterated. The impurity is probably some compound amylaceous matter, for there is both fecula and lignin; and, for reasons I need not stop to explain, it must be introduced intentionally. The amount in lump gamboge is about eleven per cent., probably too little to affect appreciably its medicinal activity. But in the coarse gamboge,—which some class with the lump variety, and with reason, since its composition is the same in kind,—the proportion of impurity is much greater. I have found in one specimen twenty-three per cent. of fecula, lignin, and moisture together; and in another so much as 51.5 per cent. In the latter the active resin amounted to no more than thirty-five per cent., or less than one-half the due proportion. It cannot be doubted that any one, who should take the same dose of such a sample one day, and of the pure variety the next, would find very good cause to complain of the precarious action of gamboge.

7. Few articles of the Materia Medica present a history more full of interest than *scammony*. Known and described by Dioscorides about two thousand years ago, it has been handed down from century to century, through an almost unbroken series of physicians and authors, even to the present time. The descriptions of those who speak from actual observation, correspond on the whole closely with the characters of the modern drug; but which is of more consequence to us, all complain of its frequent adulteration; and singularly

enough, the very kind of adulteration practised seems to have undergone little change. In some parts of the Continent it has no great reputation, and is not much in use. In Britain, however, its consumption is very great; which may be inferred from its forming a large part of the compound colocynth mass, one of our most familiar laxative pills. No substance is so seldom to be met with genuine as scammony. The utmost efforts of the druggist to obtain it pure are often unsuccessful for a long period of time; and I have met repeatedly with well informed members of the trade; who had never seen it in that state, and did not know what it was when it was presented to them. I have made many careful observations on this subject, which will soon be made public. At present a few facts will suffice. Pure scammony, which possesses a pretty clear resinous fracture and lustre, is composed, according to repeated analyses I have executed, of resin, gum, a few grains of sandy matter, and a little moisture. The gum amounts to eight per cent., and the resin, its active principle, varies from seventy-seven to eighty-three per cent., according to the age and consequent dryness of the specimen. Such scammony has for some years cost in the wholesale market about thirty-two shillings a pound; but it is rarely to be met with. The principal part of the scammony in the shops costs only from fourteen to eighteen shillings a pound; which is alone evidence enough that it is a spurious article. Three adulterations have come under my notice,—with chalk, with some amylaceous matter, and with both conjoined. The first variety has very much the appearance of our gray limestones. I may mention the composition of one merely out of a great number I have analysed. It contained 31.5 per cent. of carbonate of lime, more sandy impurities than usual, and only 43.5 per cent. of its active principle, the resin. The next variety, which may be called amylaceous scammony, presents a variable proportion of fecula, and along with this a less proportion of a principle corresponding in properties with lignin. Of several specimens of this kind I have exa-

mined, there is one which contained twenty per cent. of fecula, and about ten of lignin; and its active resin formed only thirty-seven per cent., being less than one-half of that of the genuine drug. This adulteration is not materially different from that indicated by Dioscorides; who says the makers of scammony mixed with it the ὀροβινον αλευρον, the flour of a species of pulse, believed on the authority of Sibthorpe to be the *Ervum ervilia*, or bitter vetch. The amylaceous scammony presents commonly an ash-gray color, and generally a waxy, but at times a somewhat resinous lustre. The last adulteration of importance is with fecula and carbonate of lime together. The appearance of this sort is much the same with that of the last. Frequently where there is a large quantity of chalk, I have found about four per cent. of fecula, for the presence of which it is not very easy to account; but often also the proportion is much larger. In one specimen I have found 18.5 per cent. of carbonate of lime, and about seventeen of fecula and lignin; and the resin amounted to 42.5 per cent. Now, all these spurious samples, containing only about half the active ingredient of the pure drug, were considered to be fair average specimens of the scammony of the English market. It need scarcely be added, that the compound colocynth pill made with pure scammony, instead of the common article of the shops, is very different in power from the pill usually met with. It has appeared to me, as we should expect, about twice as strong.

8. Our knowledge of the adulterations of *opium* is far from being precise. There is no substance used in medicine, into which, on account of the vagueness of its external characters, and the exceeding complexity of its composition, impurities may be more easily introduced in such manner, as to escape the notice of the practical druggist, and the researches of chemical pharmacy. At the same time, it may be doubted whether the impurities indicated by pharmaceutic authors, such as stones, sand, saw-dust, or extract of poppy leaves, are of common occurrence. Most of these substances would be

easily detected by the eye and touch of a skilful druggist, and extracts by the change occasioned in the odor. I have no new facts to add under this head. I am ignorant of the nature and extent of the adulterations of opium. But there is also another cause of variation, which is perhaps of at least equal consequence. It is well known that varieties in the plant, differences in climate, and probably, too, differences in soil and cultivation, are the source of great variations in this drug. The opiums of the Levant, of Egypt, and of Bengal, differ in their external characters and composition to a greater degree than almost any other vegetable remedy; and even that of one region varies remarkably, and in a way that can scarcely be ascribed to express adulteration. Owing to one or other or all of these causes, the opium of the English market, which comes chiefly from the Levant, is exceedingly variable in quality. The only certain method, in my opinion, of determining the quality of opium, is by detaching its morphia, especially in the form of muriate. In the form of muriate the whole active principle may be separated in a state of great purity. Now, the proportion of this salt obtained from good opium, according to my own analysis, and the experience of a very skilful manufacturer in this city, is an ounce and a half avoirdupois per pound, or about ten per cent.; and in one fine specimen of Smyrna opium, I obtained so much as one ounce and fifteeen drachms, or twelve per cent. But according to information communicated to me by the same gentleman, he has sometimes obtained in his operations upon a large scale so little as one ounce per pound, or a trifle more than six per cent. Here, then, is a variation in quality in the ratio of one to two, nearly. It is material to add, as exemplifying a statement repeatedly made above, that these opiums were very nearly of the same price, were supplied by a highly respectable wholesale druggist to an experienced manufacturer, and were believed by both to be at least of good average quality;—an excellent proof of the uncertainty of its external characters, by which alone practical men in this

country judge of its value. In medical practice we hear constant complaints of the disappointments experienced in using opium and its galenical preparations, owing to the varieties produced in their action by peculiarities of constitution, or by the state of the patient at the time; and it would be the height of folly to deny the influence of these disturbing causes. But we likewise know that varieties equal in degree and the same in kind may be occasioned by varieties in dose. I have sometimes traced to this source unpleasant effects which were at first believed to depend on idiosyncrasy. May it not, then, be worth while to inquire whether the irregularities, apparently depending on the constitutional or incidental state of the patient, do not originate, more frequently than is at present thought, in mere differences of dose?—seeing that the drug must be often administered to different individuals, and to the same individuals in different circumstances, in doses of which one may be twice as great as another.

9. To these instances of the adulteration of drugs, in the state in which they are supplied to the retail druggist, it might be well to append parallel examples of the same practice in the case of the galenical preparations of the Materia Medica, which are usually made by the retailer himself. Many adulterations of this nature have come under my notice; but it has not been in my power to examine them with much accuracy, because, on the one hand, the processes for the purpose are often tedious and sometimes unsatisfactory, while, on the other hand, some adulterations can scarcely be brought at all under the cognizance of chemical analysis. I shall, therefore, be satisfied with mentioning one only, which I have carefully examined, out of a list which, with more leisure, would easily furnish many similar illustrations. This is *laudanum;* which, as may be inferred from what has just been said, is liable to vary in consequence of varieties in the crude drug employed in preparing it, but which the following facts will show to vary to a degree which cannot be ascribed to that circumstance alone. Laudanum, which I prepared from first

rate Smyrna opiums, according to the proportions of the Edinburgh Pharmacopœia, contained 19.1 and 22.1 grains of solid matter, (dried in the vapor-bath till it ceased to lose weight,) in a fluid ounce avoirdupois; and, by a process directed towards the separation of the morphia contained in these laudanums, their value proved to be such as may be represented, for the sake of clearness and simplicity, by the numbers 120 and 130 respectively. With these facts as the basis for comparison, I have examined laudanum from no fewer than seventeen shops, fourteen of them in this city, and three in one of the chief county towns in Scotland. The results are given in the following table, from which it may be inferred that, according to one method of examination, the difference between the laudanums of the shops in point of strength, is in the ratio of three to one, and that by the other, probably more accurate method, the actual difference in value is even greater.

	Solid part of 1 fl. oz.	*Relative morphia.*
1. Prepared by myself from finest Smyrna opium,	22.1	130
2. Do. Do. also from fine Smyrna opium, somewhat inferior, .	19.1	120
3. Do. Do. from inferior opium. .	21.0	90
4. From one of the best class of shops in Edinburgh,	17.1	130
5. From another do. . . do.	10.0	40
6. From a third, do. . . do.	20.2	
7. From a fourth, do. . . do.	20.8	
8. From a fifth, do. . . do.	12.3	
9. From a sixth, do. . . do.	18.0	
10. From a second rate shop in Edinburgh,	20.8	
11. From another, do. . do. .	22.7	80
12. From a third, do. . do. .	14.6	
13. From a fourth, do. . do. .	20.6	80
14. From an inferior shop in Edinburgh, .	13.4	
15. From a second, do. . do. .	13.0	
16. From a third, do. . do. .	9.0	35
17. From a fourth, do. . do. .	7.2	
18. From a shop in a county town, .	16.8	90
19. From another of less repute, in do. .	17.5	100
20. From a third, do. . do. .	15.8	90

The deficiency in No. 8 was probably accidental, because the druggist knew to what purpose his laudanum was to be

applied,—which, it may be well to add, was not the case in any other instance. In the instance of No. 5, however, accident could scarcely account for the defect; for the laudanum from the same shop was twice found defective at an interval of six months; and besides, it evidently contained some extraneous coloring matter. No. 20 also contained a large quantity of adventitious coloring matter, which, when the morphia was removed by ammonia, gave the liquid a dark crimson tint.

II. Having mentioned these examples of adulteration,—which have been purposely chosen from among the drugs most in use, and which it would be easy, if necessary, to multiply to a far greater extent,—I may proceed to the next head of this inquiry, namely, to point out the sources of the practice in question. Under this head, those circumstances will be indicated in the commercial history of drugs, which may lead to their adulteration, together with the several quarters where it seems to originate.

Here it will be necessary to apprize those who are not conversant with the commercial history of drugs, that they pass, most of them at least, through a considerable variety of hands before they are finally distributed in the retail trade. Articles of home produce, such as indigenous plants with their preparations, and chemical compounds of domestic manufacture, frequently pass at once into the possession of the retailer; but often, too, they are obtained by retailers, especially the smaller retailers of towns and villages, through the medium of wholesale druggists, and not directly from the herbalist or chemical manufacturer. Articles again of foreign produce accomplish their passage more indirectly still. The producer disposes of them to the foreign merchant, by whom they are consigned in general to an English drug-broker at some of our great sea-ports, and particularly at London. By the drug-broker they are sold at certain stated sales, usually by sample, and while in bond; and the principal purchasers are

the wholesale druggists, or those great retailers who unite a wholesale trade to their other business. By them again the drugs are disposed of to retailers generally throughout the country; but frequently another intermediate step is made in the case of the small retailers in country districts; who purchase, not from the wholesale dealers, but from the larger retailers of the nearest great towns. It must be evident then, that the quarters where adulterations may be practised are sufficiently numerous.

There can be no doubt, in the first place, that drugs from foreign parts are often adulterated before they arrive in this country, either by those who prepare them, or by the merchants abroad, to whom they are in the first instance disposed of. *Scammony* and *gamboge*, whose adulterations have been inquired into above, are ascertained examples of this kind; and *opium*, *cinchona bark*, *senna* and many other articles from distant countries, are equally well known to receive there the extraneous ingredients which are recognised in them by the European pharmacologist.

Some of these adulterations are in all probability practised with a distinct purpose of fraud. Such may be assumed to be the object where the adulteration is of a kind which may deceive the British importer and wholesale druggist. In regard to some substances, such for example as *opium* and *senna*, the deception is frequently, perhaps generally, successful. In the case of opium I feel satisfied, that, so long as the wholesale druggist trusts to its external characters alone, he must be liable to be sometimes deceived. It is not easy otherwise to account for instances, which have come under my notice, of opiums widely different in real value having been bought and sold at nearly or absolutely the same prices, where the transactions took place between experienced individuals in the highest walk of their trade. As to senna, so successfully is it adulterated, that some of the first members of the wholesale trade in London are scarcely aware, that the highest priced variety of this drug, the Alexandrian senna, is

never pure, but invariably mixed to a considerable extent with another and comparatively inert plant: at least they were not aware of this fact in 1834, when I had occasion to converse with them on the subject. In these, and all other cases of the like kind, there seems reason for suspecting, that deliberate fraud is practised by the foreign merchant or producer.

But there are other sophistications also practised by the producer or merchant abroad,—and these probably the most numerous,—for which he is only in part accountable, or which at all events he practices without any intention of deceiving the merchant or wholesale dealer in Britain. For the spurious articles are perfectly well known to the home trade; and the wholesale price varies regularly with the purity of the imported article, and even according to its exact degree of purity. It is impossible, for example, to imagine that the maker or foreign merchant has any fraudulent view to personal profit in adulterating *scammony* or *gamboge* as he actually does, to the extent formerly mentioned; because the external characters of the different qualities are precise, and such as cannot be mistaken by any one of common experience; their import prices differ accordingly to a great extent; and in fact I have found by analysis, that these prices indicate very accurately their relative purity. What then, must be naturally asked, is the object of this practice? Is it that the wholesale druggist may be enabled to impose on the retailer with the spurious articles? It would appear not. No retailer of moderate skill could be so deceived; and from many wholesale establishments the spurious drugs go forth for no more than their real relative value.

More opportunities of information than I possess, would be required for investigating fully this apparent mystery. But I have had occasion to ascertain the true facts in respect to one instance of the kind, which will probably prove the type of many others of a similar nature. The conclusion to be drawn would seem to be, that the fault lies with the retailers, or

must be shared between them and their customers. Whether such is really the case or not, it is not easy to decide. But I shall state the facts as they were communicated to me by a wholesale druggist of eminence in London, who authorized me to make them public. The subject of his communications was scammony, which he allowed is very rarely to be had pure from any wholesale establishment. The reason he explained to me, was, that many of his customers in the retail trade,—and his own case was likewise that of all his brethren,—would not give a fair price for a pure article; that they did not ask for a pure drug, but for one of a particular price, often greatly under what it could be purchased for from the importer; and that on communicating with his Levant correspondent, and informing him what his customers wanted, he received for reply, that no Levant merchant could furnish good scammony at the prices proposed, and that it was therefore mixed up by himself and others with various proportions of chalk, to suit the varying demands of English dealers. The foreign merchant, whose letter I saw, complained of the necessity to which he was thus reduced of disgracing his occupation; sent specimens, five in number, of his several adulterations, specifying the proportion of chalk and of pure scammony in each; and requested his London correspondent to make the facts as generally known as he could to the medical profession. As one step towards executing his instructions, the information and specimens were made over to me; and on analysing the latter, I found them to be composed almost exactly as represented.

It may be strongly suspected, then, that some retailers are responsible for adulterations of the kind now alluded to;—that by unreasonably forcing down the price of some foreign drugs, they in some measure compel the merchant abroad to prepare spurious articles; which they receive, knowing them to be spurious.

Another quarter in which it may be supposed probable that adulterations are practised, is in the establishments of

the chemical manufacturers. From what was formerly stated in respect of iodine and the hydriodate of potash, it is plain that in some of these establishments spurious drugs are wilfully prepared and fraudulently sold. In one of the instances adverted to, a representation was made to the manufacturers at my request, but without occasioning, at least for a twelvemonth, any improvement in the quality of an article which at the time had an extensive sale in both England and Scotland. I have met with other instances somewhat similar. I have also met with instances where, upon inquiry, the inferior quality of the preparation was found to have arisen from accidental oversight, and with others where the cause was in all probability the want of adequate skill. It must be farther added, that a few expensive drugs, the produce of the chemical manufactories, are always impure, because they cannot be purified except at an enormous loss, while even in their impure condition they are both sufficiently dear and also quite active enough. Thus strychnia and veratria, as prepared for medical use, are invariably very impure, to the extent generally of at least fifty per cent., being never prepared in a state of purity except for the scientific chemist; and the reason simply is, that in their ordinary commercial state they are sufficiently energetic and very costly, while the pure alkaloids possess no particular advantage in a medicinal point of view, and could not be sold for less than twice or thrice the cost.

From such inquiries as I have hitherto been able to institute, it would appear that, deducting, as seems reasonable, the instances where the impurity is either allowable or accidental merely, the adulteration of chemical drugs by manufacturers themselves is very far from being prevalent. There is, on the contrary, great emulation among chemical manufacturers to produce articles of the finest quality; very many of their most important products are, in all probability, never intentionally adulterated; and certainly no retailer can be at any loss to obtain by far the greater part of drugs of this sort in a state of sufficient purity for medical use. A curious illustra-

tion of what is now said, which lately came under my notice, may be worth mentioning here, because it relates to a set of substances that have often been thought to be very impure. In consequence of having heard practitioners express their belief that corrosive sublimate and calomel are frequently adulterated, and in particular that the latter is often adulterated with the former, I examined both salts as they are sold in Edinburgh; and, after a careful analysis of five different specimens of each, some from first rate establishments, others from the most insignificant shops, it appeared that the least pure specimen of corrosive sublimate contained ninety-seven per cent. of real salt,—that the least pure of the specimens of calomel contained 96.6 per cent. of genuine salt,—and that of ten calomels from ten different different shops not one contained so much as a five hundredth of its weight of corrosive sublimate.

Farther, I am inclined to think, that where chemical drugs are adulterated by the manufacturer, the source of the practice is frequently, not fraudulent intention on his part, but—as we have already seen to be the case in regard to some spurious drugs of foreign origin—the necessity of meeting the orders of customers, who will not give the full price for a genuine article. There is no other apparent reason why a drug which ought to be tolerably uniform in its nature, such as the spirit of nitric ether, should be sold to retailers at prices so widely different as at present. There is no attempt at imposition on the part of the manufacturer, each quality bearing its own price. The purchaser of spurious articles cannot but know their quality from their price; and, consequently, he is chiefly to blame for their being introduced into the market in the first instance, as well as for ultimately dispensing them to the public.

The next quarter in which adulterations may be practised, is in the establishments of the wholesale druggists. There is still, indeed, another description of persons, besides foreign merchants and home manufacturers, through whose hands we

have seen that many drugs pass before reaching the wholesale dealer,—namely, the drug-brokers. But it is not conceived that adulterations to any material extent are practicable in that quarter, because the articles which pass through the drug-broker's hands are solely of foreign origin, and usually remain in bond in the public warehouses till disposed of by him, being sold chiefly by sample. The wholesale druggist, who may be said to be the great organ of communication between the retailers on the one hand, and the foreign merchant, home manufacturer, and herbalist on the other, has been very generally, though somewhat vaguely, accused of being the chief cause of the extent to which adulterations are now practised. I believe it will be no where denied, that a considerable proportion of the impure and spurious drugs, now currently met with in the shops, are fabricated originally in the warehouse of the wholesale dealer. But, after what has been stated as to the adulterations practised by the foreign merchant and producer, a question naturally arises whether the wholesale druggist is entirely to blame for some of those which *he* practises. That there are unprincipled men in this branch of trade, as in every other, who make profit of their customers' ignorance by fraud and imposition, may be readily granted. But considering, that a great proportion of wholesale druggists do not make more profit by the sale of spurious articles than by those which are genuine, and that they do not necessarily sell the former as such, we are unavoidably forced to lay the blame on those persons who, for whatever reason, are purchasers at prices known and declared to be inadequate.

The more the practices of the trade are inquired into, the more must one become satisfied of the general fairness of the wholesale dealers in their department of it; and, at all events, no retailer need be at any loss to obtain from them the best and purest drugs, provided he will pay the fair market price of them. I must also add, that from several of the wholesale dealers of the metropolis I have received, without possessing

any claims whatever on their confidence, the most unreserved disclosures as to the state of the drug-trade, accompanied with expressions of unequivocal regret that they should be compelled to seem accessary to the frauds which are practised on the public, and with declarations of their willingness to co-operate in putting an end to them.

The farther, then, we proceed with this inquiry, the more reason does there appear for suspecting that the adulteration of medicines, in the shape in which they are made up for the retail market, is of a piece with one of the common vices of trade; and that some persons, although they do not with their own hands fabricate the spurious articles sent forth by the wholesale druggist, chemical manufacturer, and foreign merchant, are essentially not less instrumental in fabricating them, by requiring that they shall be supplied at a price for which genuine drugs notoriously are not to be obtained, and by receiving and dispensing what they know to be sophisticated.

But this is not the only kind of imposition on the public for which some retailers have to answer. Other adulterations are also practised directly in their own establishments. Such, for example, is the chief source of many spurious galenical preparations, the greater part of which must necessarily be made by the retailer for occasional consumption. Not a few of these, indeed, are of low quality, simply because the crude drugs from which they are prepared are themselves inferior. But, besides, there can be no question, from such facts as those stated above in regard to laudanum, that the galenical preparations often owe their inferiority to more direct interference on the part of the retail dealer.

It does not seem necessary to inquire here into the several causes that have led to the practices among retailers now adverted to. But it is only fair to them to mention, that one obvious cause is the absurd propensity of many of their customers to value medicines rather by their cheapness than according to their quality and efficacy. It would be wrong

were I not also to express my perfect conviction, that the profession of chemist and druggist contains many highly respectable individuals, whose undeviating desire is that no medicines shall either enter or quit their establishments except what are of undoubted purity, and who exercise a degree of skill and care to secure that object which would scarcely be believed by those not conversant with the nature of their trade. Nor can I advert to this circumstance without being farther called on to acknowledge, that I have been indebted for a great deal of valuable information, on the very subject of the adulteration of drugs, to several members of this profession. One gentleman, especially, in extensive trade in this city, whose name, for obvious reasons, cannot properly be mentioned, has, in a manner, thrown open his whole establishment to my most minute inspection, and obtained for me a great part of the opportunities of instruction I have enjoyed. It may be well, perhaps, to add, that I have thus become cognizant of two general facts of no mean consequence in the present inquiry:—that, on the one hand, in the present state of matters the most skilful and conscientious in the retail trade cannot always protect themselves against serious imposition,—and that, on the other hand, among its respectable members there is no want of inclination to co-operate in any steps that may be taken to enhance the respectability of the profession, and to render the unprincipled amenable to the public for their conduct.

III. It now remains to consider the last head, under which it was proposed to discuss this subject,—namely, the measures by which it seems most practicable to accomplish the prevention, or at least the abatement, of the present practice of adulteration. If the Colleges move in the matter, it is right that they should not go before the public without being prepared to recommend the adoption of certain checks; and therefore the following hints are thrown out for their consideration.

1. In the first place, there can be little doubt, that, both for this and various other important purposes, the profession of chemist and druggist ought to be elevated as far as possible by an improvement in education, and protected by some of the rights due to a legally constituted Society or Incorporation. I have heard the government of this country blamed for not having instituted such a body long ago; and in my opinion the evils which have resulted from the neglect on this head are far deeper and more extensive than most persons are aware of. On the very face of the question it certainly appears extraordinary, that, while in every other great European kingdom the profession of retail druggist is a highly respectable one, closely connected with science, incorporated by statutes, and exercised only by those who have undergone an express course of study, and been licensed after examination,—in Britain alone is it allowable for any man, no matter how ignorant and uneducated, to assume the name and character of chemist and druggist unchallenged.

The advantages of an institution for the protection and improvement of Pharmacy are manifold. For first, by conferring a certain *status* on the followers of what ought to be a scientific art, their character and respectability cannot fail to be greatly raised. Then, it will at once furnish the means of pointing out to the public those who are worthy of confidence. Farther, it is an important preliminary for the establishment of a board of education, by which the studies of the future members of the profession may be regulated, and their fitness for entering on it ascertained by examination. But again, it is also a necessary step for the accomplishment of one of the measures on which I am disposed chiefly to rely for abating the practice of adulteration, namely an effectual visitation of the druggist's shops. And, lastly, an institution of this kind appears not unlikely to promote the interests of science, more especially of chemical science. It is not trade alone, and the immediate interests of the public, which have suffered in this country by the want of an institution for

regulating and encouraging Pharmacy. Science, in this, as in many of its other departments, has been a deep loser by the ignorance or supineness of our successive governments. In France every *pharmacien*, and in Germany every *apotheker*, must have undergone a liberal education; and in particular he must have made chemistry a subject of careful study. And what has been the result? Simply, that this profession has supplied in each of these countries a multitude of the most eminent scientific chemists of Europe. In Britain, alas! we look in vain for a single chemist worthy of the name among those exercising the same profession.* And to what is this lamentable fact to be ascribed, except to the circumstance that in Britain all may, and most do, exercise it without any particular education at all, either in chemistry, or in other liberal arts or sciences? Germany and France may each number ten chemists of celebrity for one to whom Britain can point. Whence can this arise unless from the almost total want with us of a legalized profession to foster the science?

It cannot be expected that in the present place any details should be entered into as to the mode of constituting a Society of Pharmacy. But certain general principles may be here adverted to as essential to its success. 1. Its affairs should be entrusted to a Board, whose chief duties should be the examination of candidates for license and the visitation of druggists' shops. 2. In order to impart at once a due degree of respectability and some scientific character to its constitution and proceedings, it would be right that this Board should, in the first instance at least, consist in part of members from the other branches of the medical profession. 3. While considerable liberality might at first be allowable in the admission of licentiates, these should eventually consist only of individuals who have undergone a certain course of study, and an examination as to their fitness to practise pharmacy; and candidates should be required to produce evidence of possessing a com-

*I am informed the late Dr. Murray commenced life as a retail druggist. But this and any similar instances do not affect the argument.

petent knowledge of at least the following branches,—namely, Latin, Chemistry, Botany, Practical Chemistry, Practical Pharmacy, and Materia Medica. 4. Licentiates of the college should be required to abandon medical and surgical practice. 5. It is not conceived to be at all necessary or even advisable, that all chemists and druggists should be compelled to apply for a license. Entrance into the body may be safely left optional, at all events for some time,—but with the condition, that every unlicensed person who may assume the title appropriated to the licentiates of the body, shall by doing so incur a severe penalty.

2. The second measure by which the frequency of adulterations may be in some measure checked, is, by our colleges of physicians adopting in their Pharmacopœias an addition, by means of which the attention of practitioners and of druggists may be pointedly turned to the most simple and accurate criterions for determining the requisite purity of drugs, and their freedom from certain known impurities. An alteration of this kind was resolved on a few years ago by the Edinburgh College of Physicians, and was proposed by them to the sister college of London, in the course of certain negotiations towards the establishment of a conjunct or National Pharmacopœia. The London college, though apparently disinclined to the change at first, have since endeavored to adopt it in the late edition of their Pharmacopœia. But, if the present were a fit occasion for criticising that publication, it would not be difficult to show that this department of it is not exactly fitted for the practical purposes here contemplated.

From such attention as I have been able to give to this subject, I feel assured that a set of rules may be devised for almost every important drug, mineral, vegetable, and animal, which any one may apply with the ordinary knowledge of practical chemistry now acquired by every medical student educated at the school of this city, and by means of which it may be ascertained that the customary adulterations are absent, and each article of the requisite degree of purity. It is

undeniable that such a method of investigation, which combines chemical and external characters, is infinitely more precise and searching than the latter characters singly, which at the present moment are almost alone employed by practical men, on account of their ignorance of the former.

3. In the third place a great proportion of adulterations would be efficiently checked by a well organized system of visitation of shops. I confess that at one time little advantage seemed to me attainable by this measure. The length of time required to make a thorough inspection appeared so great, as to render it impracticable for a moderate body of individuals to examine properly any material number of establishments even once or twice a year, without their whole time being devoted to the duty. But, since becoming more familiar with the external characters of drugs, as well as the applications of chemical analysis to the discovery of their adulterations, and since witnessing more especially the extraordinary tact and rapidity with which druggists of experience can ascertain the respective qualities of numberless samples of some kinds of drugs placed before them at the same time,—I no longer entertain any doubt that an effectual visitation of shops may be instituted by a properly organized body. For the success of a system of inspection it seems essential that a committee of inspectors should be appointed for each metropolis in the empire; that the members be nominated by the general body; that they have the power of nominating assistants or deputies in country districts; that they shall receive a salary in proportion to the duty discharged; that they shall be so numerous as to ensure the visitation of every shop at least twice a year; that penalties be inflicted for the wilful possession of spurious drugs; and that these penalties be recoverable by a simple legal process.

Some may argue in opposition to the views here expressed of the utility of inspections, that the measure has been already tried in this country, and found to be inoperative. It is true that the Colleges of Physicians of London and of Edinburgh,

possess the right of visitation, and that this right has been long abandoned by the latter college, and is practised by the former with no material good effect. But it would be an easy matter to show that a College of Physicians is not the proper body with which to entrust so peculiar a duty; and in point of fact, though there were no other reasons for failure, it is quite sufficient to entail disappointment and ill success, that such a body cannot be expected to produce a competent number of individuals of adequate practical skill. This line of argument, moreover, is very effectually answered by referring to the experience of France and Germany, where the task of visiting shops is lodged in the hands of the most eminent members of the Pharmaceutic Colleges, and where the inspections are consequently understood to be made with regularity, and vigor, and excellent effect.

In the fourth place, some might think that an effectual check against many adulterations would be found in similar visitations of the warehouses of wholesale druggists; which might be instituted the more easily, and carried on the more efficiently, that these establishments are few in number and confined to a few large towns. But insuperable obstacles exist to such a measure. It would be considered invidious to subject individuals to the superintendence of a body which it could scarely be any part of their interest to join as members. Many wholesale druggists make preparations, both chemical and galenical, the processes and apparatus for which they are entitled to keep secret. Most of them supply to other trades besides retail druggists a great variety of drugs; which, for any other purpose except medicinal use, may be of inferior quality, without material injury to the public, and which, therefore, it would be impossible to prevent them from vending in such a state. Besides, while an inspection of wholesale warehouses would prove but a trifling check on retailers, it would appear from what was formerly stated, that an effectual visitation of the retail shops, and an improved education of retailers, would soon extinguish in a great measure on the part of wholesale dealers the reasons which at present exist for

practising adulterations. But farther, a considerable check might be imposed on the malpractices of unprincipled men in the wholesale trade, and also, it may be added, in the trade of the manufacturing chemist, by enabling the retailer, who may have been convicted of possessing spurious drugs, to recover the penalty from manufacturers or wholesale dealers, where he can prove that the adulterations had been practised before the articles left their establishments.

Such are the measures for the prevention of adulterations, which appear the most easy to enforce, and most likely to answer their object. That difficulties will be met with in laying down the details, and that obstacles will arise at first on applying them in practice, no one can pretend to deny. But no useful object was ever attained in a civilized, and most of all in a free country, without serious difficulties and obstacles to be surmounted. And I am not willing to allow that the obstacles in the present case are at all likely to prove insuperable; since it will be generally conceded that the object in view is most important, the means obvious and practical, and opposition not to be dreaded where alone it might prove powerful,—namely on the part of retail druggists;—for it would be very extraordinary that they, at least the better class of them, should oppose a measure tending so much and so directly to increase their professional as well as their individual respectability.

Neither on the other hand can it be imagined that the several checks which have been enumerated exhaust the possible list of corrective measures. Others will in all probability present themselves, when the inquiry shall have attracted more especially the attention of druggists both in the retail and wholesale trade, to whose opinion, without a doubt, great deference ought to be paid. Without going any farther into the matter, I may suggest, for example, whether means may not be found for preventing altogether even the importation of many spurious drugs, which are fabricated in foreign countries, and which it would be exceedingly easy to detect in their passage through the custom house. It might also be

considered whether advantage might not be derived from the stated publication of authentic lists of the price of genuine drugs, and the announcement from authority of recently observed adulterations. But these and various other subsidiary measures will be better left for that ulterior inquiry which it is hoped will be instituted upon the whole question.

Edinburgh Med. and Surg. Journ. for April, 1838.

ART. XXV.—ON THE IDENTITY OF THE BARK OF THE STRYCHNOS NUX VOMICA WITH THE FALSE ANGUSTURA OF WRITERS ON MATERIA MEDICA.

By W. B. O'Shaughnessy, M. D., Professor of Chemistry, Medical College, Calcutta.

Few medicinal barks have ever attracted more attention than that generally termed the false Angustura. Introduced into Europe originally as the bark of the *Galipea febrifuga*, its poisonous properties soon denoted a different source. The *Brucea ferruginea* and *anti-dysenterica* were next suspected, and this erroneous idea continued to be entertained so long, that on an alkaloid being discovered in the bark, in 1822, it was named *Brucine*, in conformity with the supposed origin of the bark. In 1823, however, it was ascertained that the bark in question arrived in Europe exclusively from South America, and not from the shores of the Red Sea, where the *Brucea ferruginea*, or *vooginoos*, is indigenous.

The question has continued at issue, from 1825 to the present period. In 1828 was published M. Fée's admirable work on the Natural History of Remedies; and this author, whose elaborate research is quite unsurpassed, describes the false angustura as "Arbor ignota, habitat in America meridionali." Dr. Duncan, in the last edition Edinburgh Dispensatory, 1830, says the tree from which the false angustura

is obtained, "is not yet known, but it is a native of South America, and therefore it is not, as formerly asserted, the bark of the *Brucea anti-dysenterica* which grows in Abyssinia." p. 340.

In Dr. Thomson's last edition, 1833, p. 226, we find no further information than a brief allusion in a foot note to the existence of the spurious bark, and to Plamba's obsolete observations regarding its history and name.—p. 226, edition, 1838.

The first hint we meet of the true nature of this bark occurs in the valuable Manual of Materia Medica, by Vavasseur and Edwards, in which, p. 269, the authors observe,—"This substance, obtained from South America, is probably yielded by a strychnos yet undescribed, and not by the *Brucea anti-dysenterica*," &c.

Lastly, in Dr. Christison's unrivalled work on poisons, last edition, October, 1835, p. 806, we find the author observing—"It was long supposed to be the bark of the *Brucea anti-dysenterica*, but the latest inquiries seem rather to point at its being the produce of a species of strychnos, and perhaps of the familiar species, *S. nux vomica*."

Such is a fair outline of the history of this bark up to the latest period. Since the last meeting of the Society, I have been enabled to clear up all doubts on the subject, and to identify the false angustura as the bark of the nux vomica tree.

The subject was brought to my notice by my having been intrusted with the analysis of a crystalline substance supposed to have been prepared from the bark of the Rohun tree, (*Swietenia febrifuga.*) My experiments showing that the crystals were *Brucine* with traces of strychnine, the presumption immediately arose that the bark from which the crystals were obtained was the bark of the *Strychnos nux vomica*, the only poisonous strychnos abundant in the Bengal jungles with which the natives are familiar.

Specimens of the bark from which the crystals were pre-

pared, of the *kuchila* (native name of nux vomica bark) from the bazars, and from a *Strychnos nux vomica* tree in the Botanical Garden, kindly supplied by Dr. Wallich, were readily procured and compared with each other—all were found identical in their physical and chemical composition, all yielded *Brucine* and traces of *strychnine*, and all produced the same toxicological effects.

On a reference to the characters assigned by the authorities I have quoted as distinctive of the false angustura, we find the following chemical tests:—1st, nitric acid, which changes the interior of the bark to a blood-red color, and causes the red external exuberance to become green; 2dly, the prussiate of potash, which causes in an infusion of the bark a faint green color; and 3dly, sulphate of iron, which changes the infusion to a deep green. To all these re-agents the nux vomica bark presents the described indications.

The most remarkable and curious of the external characters of the nux vomica bark, and one in itself an indisputable proof of its being the false angustura, is the singular red exuberance which occurs on the outer surface of the specimens now presented to the Society.

This red exuberance was the first property of the spurious angustura bark which attracted attention in Europe. M. Fée states that it frequently happens that "the false angustura has a spongy exuberance of a very beautiful rust color, and that M. Pelletier, who had analysed it, had, by mistake, described it as a lichen of the genus Chiodecton.

M. Fée denies that it is a lichen, and considers it as the result of a leprous disease of the bark, the stages in which he clearly and correctly describes. It commences, he states, by little regular prominences, surrounded by decayed epidermis. These tubercles increase in size, become irregular in outline, and confluent, and pass through the several shades between a clear yellow and iron-rust color.

When the disease is of long standing, the part affected acquires considerable thickness, and is much deformed. No

trace of organization can be detected in it by the naked eye. Examined by the microscope, it is found to be composed, not of cellular tissue like Cryptogamic plants, but of true vascular tissue as in the Phanerogamic class,—a fact sufficient to show that the exuberance is not a lichenoid production.

It is altogether unnecessary to add a minute description of the nux vomica bark, since Fée's account of it under the name of the false angustura, is as accurate as possible.

I trust the identification of the long doubtful false angustura may be of practical therapeutical utility, as well as pharmaceutical interest. It is extremely rich in Brucea, an alkali of exactly the same properties as strychnea, but fortunately but of one-twelfth the energy of that poison. According to the recent experiments of Andral, Magendie, and Chevalier, Brucea is extremely effectual in the cure of paralysis, atrophy, chronic rheumatism, sciatica, and several analogous affections. I have much hope, too, that it will be found useful in the treatment of intermittent and remittent fevers. The bark will now become an article of consequence as an export, since the preparation of Brucea as a medicine was limited or almost prevented by the rare and casual supply of the bark from which it was obtained. In fact, Brucea was only to be found in the museums as a curiosity. In the shops its price was as high as forty shillings the ounce—hence the virtues of the remedy were only ascertained, its benefits not diffusible. We can now prepare it in Bengal for three or four rupees the ounce, and I have no doubt its consumption will become very extensive.

Journ. Calcutta Med. & Phys. Soc., for Jan. 1837.

ART. XXVI.—NOTES TAKEN AT THE POST-MORTEM EXAMINATION OF A MUSK DEER. By A. Campbell, Esq., Nipal Residency, June 24, 1834.

(*Addressed to* J. T. Pearson, *Esq.*, *Curator*, *Asiatic Society.*)

I have the pleasure to send you, for the museum of the Asiatic Society, a very perfect skin (head and feet included) of the Thibetan Musk Deer, as well as of the *Wah* of the Bhotiahs, *Ailurus fulgens* of the zoologist, and hope they may reach you in the same perfect state they are now in. The musk has been a full grown male, and a large one too. The natives of *Nipal* make a marked distinction between the *Trans-Himalayan* animal, and the *Cacharya* one, or that which inhabits the country along the foot of the snows on this side of the great snowy mountains; ranking the musk of the former much higher than that of the latter variety. The specimen now sent is of the *Trans-Himalayan* animal. The notes appended are of the *Cis-Himalayan* one. Through the kindness of Mr. Hodgson, I have had opportunities of examining specimens of both animals, but without observing any important difference between them. The musk pod of the Thibetan animal is covered with short close hair, while that of the *Cachar* one is clothed with very long hair, and hangs more loosely from the belly. I believe the musk of both, when unadulterated, to be much alike, and that the superficial value attached to the Thibetan animal's produce, arises from the circumstance of its being less frequently impregnated with foreign substances, for the purpose of increasing its weight and bulk, than the *Cachar* article. The pods, as they are found in the market, whether *Thibetan* or *Cacharya*, vary a good deal in appearance, and hence the general division of them above noted is subdivided: the thinner skinned ones being called *Kaghazi*, or papery, the thicker skinned ones *Ganauta.*

You will readily observe that the anatomical notes are very

incomplete, and that they have been copied "*in the rough*" as made at the dissection; but their accuracy, and the interesting nature of the animal they appertain to, may nevertheless render them acceptable to the curious in such matters.

A musk deer, (*Cacharya,*) male, mature.—Length from vent to occiput, two feet two and a half inches: occiput to snout, seven inches: tail a mere rudiment, one and a half inch long, terminating in a tuft of hair like a shaving brush. The anus surrounded by a ring of soft hair, the skin under which is perforated by innumerable small pores secreting an abominably offensive stuff; pressure brings out the stuff liquid, like melted honey. Scrotum round, and naked; space between it and anus naked, also for a small space towards the groins. Penis three and a fourth inches long, terminating in the musk bag, which is in this animal globular, a little flattened on the surface towards the ground—one and a half inch in diameter either way, and thickly covered with long hairs; it is pendent from the belly, not like the *Bhotiah* musk deer examined last year, in which it was bound up to the abdominal parietes. At the centre of the musk bag is a circular hole, large enough to admit a lead pencil; its edges are naked and moist. At the posterior margin of this hole is the orifice of the penis. The penis is, in fact, terminated by the musk bag, which might be called correctly the preputial bag. The bag is composed of two distinct membranes, apparently unconnected with one another, except at the margin of the circular external hole. The external membrane is vascular and strong; the internal one is silvery, shining, and not vascular: it resembles the retina of the eye, as it is seen on dissecting the eye from without. The inner membrane, which forms the cavity of the bag, is lined internally with a few scattered hairs. The musk is soft, of a reddish-brown color, and granular: its appearance and consistence is precisely that of moist gingerbread. Around the margin of the hole of the bag is a circle of small

glandular-looking bodies, more numerous towards the side of the penis, (the posterior margin.) The flesh of the animal is dark red, and *not of musky smell.* Bladder very large, six inches long, two and a half broad. The liver flat, one lobe only, with a cleft in its margin at the attachment of the central ligament. Length of liver from left to right six and a half inches, from anterior to inferior aspect three and a half inches thick: at its extreme right, one inch; at its extreme left, half an inch. Gall-bladder, oval-shaped, pendulous from right half of liver, three inches long, two and a half in diameter. The gall duct penetrates the intestine two and a half inches from the pylorus of last or fourth stomach. Spleen thin, four inches long, two and a half broad. Kidneys unilobed, not sulcated on their surface, one and a half inch long, one inch broad. Stomachs four, in all respects ruminant. The large bag, or first stomach, mean length eighth inches, breadth six inches. Entire length of intestines forty feet. From the pylorus to cæcum, twenty-eight feet; from cæcum to vent, twelve feet. One cæcum thirteen inches long, and two inches in diameter. The small intestines, which are round and thread-like, as well as the larger ones, are very thin-coated; average diameter of large ones near the rectum, two inches. Right lung, the larger, three-lobed; left lung three-lobed also, a small centre lobe of which lies below the apex of the heart. Heart three inches long, two in diameter.

Another Musk Deer, May 28, 1835.

No branches from the arch of the aorta. The ascending aorta one inch from the arch, gives off, *first*, a common trunk, immediately divided into the left subclavian and left vertebral; *second*, two and a half inches higher: it (the aorta) divides into two branches, viz., the right cephalic, and the common trunk of the right subclavian and right vertebral.

The os hyoides is formed of a small centre body and two horns, each of the two pieces having a posteriorly directed process for insertion into the head of the thyroid cartilage.

The cornua are articulated with a small process of the temporal bone below the meatus auditorius. The larynx one inch long. The trachea to the first branch given off, (which is on the right side,) eight inches long: one inch further on it divides at once into four branches, the first branch goes to the highest of the four lobes of the right lung. The cartilaginous rings of the trachea incomplete behind.

Dimensions of the "Wah" of the Bhotiahs.

Ailurus fulgens, or male, mature.

From snout to tip of tail, thirty-seven and a fourth inches.

From the sole of fore-foot to superior crest of scapula, nine and a half inches.

From foramen magnum to snout, taken with callipers, five and a fourth inches.

Length of tail six inches.

From first cervical vertebra, to first vertebra of the tail, sixteen and three-fourths inches.

Greatest circumference of head round the angle of the jaw, ten inches.

Length of humerus, five inches.

Length of fore-arm, four and a half inches.

From wrist to tip of middle finger, two and three-fourths inches.

Length of femur, four and a half inches.

Length of tibia, and fibula, five and a half inches.

From heel to tip of middle toe, four and a half inches.

Girth round lower part of thorax, twelve inches.

From anterior edge of the orbit to tip of snout, one and a half inches.

From external opening of the ear to the tip of the nose, three and a fourth inches.

Journ. Asiatic Society of Bengal, for Feb. 1837.

ART. XXVII.—NOTICE REGARDING THE COMPOSITION OF JAMES' POWDER.*

By Douglas Maclagan, M. D., Fellow of the Royal College of Surgeons of Edinburgh.

The well known "Fever Powder" of Dr. James is a patent nostrum which has been in constant use for a century, both in general and domestic practice, as a febrifuge. Its mode of preparation has always been made a secret; and though it was avowed to contain antimony, its composition was not known, until Dr. George Pearson gave an account of an analysis of it, from which he inferred its composition to be oxide of antimony and phosphate of lime. The London College of Physicians, considering it to be a valuable preparation of the active substance antimony, introduced into their Pharmacopœia an imitation of the patent medicine, under the name of *Pulvis antimonialis*, which has subsequently been adopted by the other British Pharmacopœias. This *Pulvis antimonialis* has always been prepared by roasting together hartshorn shavings and the black sulphuret of antimony, by which process the former, by the destruction of its animal matter, is left in the form of phosphate of lime, and the latter acquiring oxygen is converted into the second compound of antimony and oxygen, now called antimonious acid. Both James' powder and the *Pulvis antimonialis* are rather heavy, white, insipid substances. Their medicinal properties are to promote perspiration, and, if taken in large doses, to excite vomiting or purging.

But though it was known from the specification lodged in Chancery by Dr. James, that his nostrum contained antimony, it was equally well known that it could not be prepared according to the formula there given, and therefore the exact state of combination in which the antimony existed was not ascertained. Dr. George Pearson, in the eighty-first volume

* Read before the Royal Society of Edinburgh, 15th January, 1838.

of the Philosophical Transactions, first published a series of experiments which he had undertaken with a view to determine this point. Mr. Chenevix, in the Philosophical Transactions for 1801, also made known some observations on this substance. Berzelius, in his *Lehrbuch*, casually notices some experiments made by himself on a portion of James' powder; and lastly Mr. Richard Phillips, in the twentieth volume of the Annals of Philosophy, gives an account of the composition of the *pulvis antimonialis* of the Pharmacopœia.

Dr. Pearson's analysis is laborious and complicated, and, from a great part of his experiments, little information can be derived. He found that water dissolved a small portion of James' powder, and that what was dissolved consisted of lime in combination with phosphoric acid, and a small portion of metallic oxide. The remainder of the powder he subjected to the action of acids and other re-agents, and was led to conclude that it consisted of forty-three per cent., of phosphate of lime, and fifty-seven of a calx, *i. e.* oxide of antimony, which he believed were united together as a triple compound. He detected a trace of iron in James' powder, occurring as an accidental impurity; and Mr. Phillips notices the same circumstance in his experiments on *pulvis antimonialis*. This, most likely, is in both cases derived from the apparatus employed in the manufacture, and probably accounts for the fact, that even with colorless muriatic acid the James' powder gives a solution of a slightly yellowish tint.

The paper of Mr. Chenevix (*Phil. Trans.* 1801,) is written chiefly with the intention of suggesting the propriety of preparing the powder by precipitation, by which means the uncertainty always attending the action of furnace heat might be avoided. He proposes to dissolve together in muriatic acid the protoxide of antimony and phosphate of lime, and to precipitate them by ammonia. This might certainly give us a useful preparation of the protoxide of antimony, but it would be widely different from James' powder, which consists of the peroxide, a substance of a totally dissimilar nature.

At the same time it is obvious that the phosphate of lime can have no other effect than that of increasing the bulk of the powder. In the course of his paper Mr. Chenevix mentions his having made an analysis of some specimens of James' powder, which he believes generally to contain about forty-four per cent. of peroxide of antimony, of which Dr. Pearson found about fifty-seven. Mr. Chenevix likewise gives his reasons for believing the ingredients of James' powder to be mechanically mixed, not chemically combined. The experiments of Berzelius on James' powder are mentioned casually in his system of chemistry. He states that he found about one per cent., to be soluble in water, and he regards it as an antimonite of lime. The residue, he says, contains about two-thirds antimonious acid, and one-third phosphate of lime; this makes the proportion of peroxide of antimony about sixty-six per cent., which is higher a good deal than Dr. Pearson's. The Swedish chemist likewise regards the powder as being a mixture of its ingredients, not a chemical compound.

The most recent observations bearing on this subject are some remarks by Mr. Richard Phillips, in the twentieth volume of the Annals of Philosophy, on the *pulvis antimonialis* of the Pharmacopœia. This he regards as consisting of from thirty-five to thirty-eight per cent. of peroxide of antimony, and from sixty-two to sixty-five of phosphate of lime. Mr. Phillips does not seem to have tried whether any part of the powder was soluble in water; and he did not believe that there was any protoxide (sesquioxide) of antimony in the portion dissolved in muriatic acid. He did not, however, employ as a test the sulphuretted hydrogen gas, which is the most certain method of detecting antimony in solution, and his other experiments on this point are not satisfactory. Mr. Phillips also regards the *pulvis antimonialis* as a mere mixture of its ingredients.

It thus appears from these experiments that the general opinion with regard to both these preparations, is, that they consist of an insoluble oxide of antimony and of phosphate of

lime, not chemically combined, but mechanically mixed in variable proportions.

In general, they are believed, in point of medicinal virtue, to be nearly equivalent to one another, but most practitioners seem to find that the patent medicine is the less variable in its action of the two. From what I have been able to observe of the efficacy of these two powders, I am induced to subscribe to the above opinion; at the same time, I have often been disappointed in finding any beneficial effect from the true James' powder, as well as from the *pulvis antimonialis*. I can by no means subscribe to the assertion of some physicians, that either of these preparations is invariably inert, but on the contrary, have several times seen purging, vomiting, and sweating all produced by them. A substance, however, which is uncertain in its action, is even worse than one which is known to be inert, and, therefore, this last statement cannot be held as being much in favor of either of these medicines. Their inefficacy has been ascribed to their chemical composition, which the above analysis would lead us to believe to be of antimonious acid and phosphate of lime,—the former a very insoluble substance, the latter perfectly inert. None of these experiments, however, seem to offer any satisfactory explanation of the fact that these medicines are uncertain in their action, rather than inert. I have, therefore, been induced to make an examination of some specimens of James' powder, with a view to ascertain this if possible.

There are two sorts of James' powder found in the shops, one sold by Messrs. Butler and Company, bearing the signature of a Mr. James, a descendant of the inventor, who manufactures it; the other made by Messrs. Newberry of London, each of which professes to be prepared according to the original formula of Dr. James. Both preparations are alike in external appearance, except that in the specimens which I have met with, that prepared by Messrs. Newberry seemed to be more finely powdered than the other.

One hundred grains of Butler's James' powder were boiled

for some time in distilled water, and were found to have lost two and a quarter grains. The solution yielded to sulphuretted hydrogen, a precipitate of sulphuret of antimony equal in weight to less than one-half of the loss of the James' powder. It likewise yielded an abundant precipitate with oxalate of ammonia, and when tested with lead and nitrate of silver showed slight traces of phosphoric acid. This portion dissolved in water is said by Berzelius, who examined one specimen of James' powder, to be antimonite of lime. It would appear likewise to contain some soluble superphosphate. When the solution is allowed to cool, it becomes hazy at a temperature of about 120°, and at about 70° begins to deposit a white powder, which, if it rest long, adheres firmly to the glass. It can, however, be redissolved by heating the solution, or by adding a small quantity of muriatic acid. The deposition, however, does not take place if the solution is very much diluted.

Twenty grains of the James' powder which had been treated as above were boiled for some time in pure strong muriatic acid, and seven grains remained undissolved. The solution was cautiously diluted with water, but contrary to my expectations no sesquioxide of antimony was thrown down. A large quantity of water was then added, and the fluid still remained perfectly clear. It was then exposed to a brisk current of sulphuretted hydrogen gas, and yielded a copious precipitate of sulphuret of antimony, which after being collected with the usual precautions, washed and dried, was found to weigh two grains.

The filtered solution was then boiled to expel all traces of sulphuretted hydrogen, carefully saturated with ammonia, and oxalate of ammonia added, which threw down an abundant white precipitate. This was allowed to remain in a warm place for twenty-four hours to settle; the oxalate was collected, washed, and dried, and was found to weigh thirteen grains. From these results it appeared that the composition of 100 grains of the James' powder was,

Antimonite of lime with some superphosphate,	2.25
Sesquioxide of antimony, ...	9.8
Antimonious acid, ...	34.21
Phosphate of lime, ...	53.21
	99.47
Loss, ...	.53
	100.00

The experiments were all carefully repeated, and the results always approximated within a few tenths of a grain in the 100 parts.

I likewise endeavored to determine the amount of phosphate by precipitating the phosphoric acid by lead. The result was so near as to confirm the statement given above, but the process is more tedious; and as the phosphates of lead are known not to be always identical in composition, I preferred estimating the phosphate of lime by ascertaining the quantity of the base.

Finding thus that the James' powder contained a proportion of sesquioxide of antimony, I repeated my experiments with other specimens of the powder, and found, that though all of them seemed to consist of the same ingredients, yet none of them contained these in similar proportions. Thus, without entering into details, I found another sample of this same James' powder to contain 2.8 per cent., soluble in water, 4.86 of sesquioxide, (only about half of what was found in the other specimen,) 40.82 antimonious acid,—the phosphate of lime which constituted the remainder being almost the same in quantity as in the other.

I then examined a specimen of James' powder prepared by Messrs. Newberry, and its composition appeared to be 3.4 soluble in water, 2.89 sesquioxide of antimony, 43.47 antimonious acid, and 50.24 phosphate of lime. Of the part soluble in water a very small proportion only seemed to be antimonite

of lime, the quantity of sulphuret which it yielded being only 0.3 grain, and the phosphoric acid being indicated in much larger quantity.

On making a set of comparative experiments with *pulvis antimonialis*, I found it to correspond in composition with the true James' powder, but, like the patent medicine, to vary very much in the proportion of its ingredients. Thus in one specimen I found only 0.8 grains soluble in water, the sesquioxide amounted only to 3.98, the antimonious acid was 50.09, or rather more than one-half of the whole, and the phosphate of lime indicated by oxalate of ammonia corresponded within a few tenths of a grain to the remainder of the 100 parts. It would therefore seem from these experiments, that both James' powder and its imitation contain a proportion of antimony in a soluble and therefore active state; that this proportion varies very much, being in the James' powder sometimes equal to more than nine per cent., at other times less than three.

Mr. Phillips' experiments, by which he satisfied himself that there was no sesquioxide present, at least in the *pulvis antimonialis*, appear *a priori* to be inconclusive, and the above experiments prove, I think, that he was mistaken. He inferred that the muriatic solution contained none of this oxide, because, like the common muriate of antimony, it did not let fall any precipitate on diluting it with water. Had he employed the sulphuretted hydrogen he would have been set right on this point. I find that this oxide, as contained in James' powder, does not require for its solution that the muriatic acid should be either concentrated or boiling, but that it will take it up at common temperatures, and when diluted with three times its bulk of water.

It is certainly a curious circumstance, that in a preparation which has been exposed to a red heat, we should find any sesquioxide of antimony, which is well known at such temperatures to be converted into antimonious acid. May it not be that a certain proportion of it is combined with part of the

phosphate of lime in the form of a triple salt, in which state it escapes the action of the fire? There seems to be no reason to suppose that the antimonious acid in James' powder is chemically combined with the phosphate of lime, as was believed by Dr. Pearson, but merely that it is mechanically mixed with it.

If this account of the composition of James' powder should be found correct, it will, I think, afford a sufficient explanation of the uncertainty of this medicine, and of the very different estimation in which it is held by practitioners. Whatever virtues it possesses are probably due to the sesquioxide which it contains, and this we have seen to be the most variable of its ingredients. From the similarity of their composition, it seems probable that both James' powder and the *pulvis antimonialis* are prepared in the same way. The patent medicine seems, however, to have been found to succeed oftener than the preparation of the Pharmacopœia, which may be owing to its being in general richer in sesquioxide from being more carefully exposed to the fire. I regret that I have not had time to compare a greater number of specimens of each, in order to see whether or not this is the case.

There does not, however, seem to be any thing in the composition or superior efficacy of James' powder, to justify the enormous price at which it is sold. Bottles which contain one ounce are charged at the extravagant rate of 1*l.* 4*s.*, whilst as much *pulvis antimonialis*, perhaps little inferior in value, may be had at any laboratory for 6*d.* or 8*d.*

Edinburgh Med. and Surg. Journ. April, 1838.

ART. XXVIII.—THE ACTION WHICH CHLORINE EXERCISES UPON THE ORGANIC SALIFIABLE BASES.

(*Presented to the Academy of Science, Feb.* 19, 1838, *by* J. PELLETIER.)

IN a paper offered to the Academy of Science, I have examined the action which iodine exercises on the organic salifiable bases, and have shown that, with some exceptions, iodine unites in definite proportions with these substances, without effecting decomposition. I proposed to treat fully, in a second essay, of the action of chlorine upon these same substances, and had collected a number of observations, when I was arrested by difficulties, which, in the present state of the science, it was impossible to overcome. In fact, I found that chlorine always acted upon the elements of the organic alkalies, giving rise to new compounds, produced by very complicated reactions. But, since the action of chlorine upon the binary and ternary compounds of the organic kingdom has not been perfectly investigated, and the laws which regulate its action are not positively understood, how can we hope to conquer the difficulties which, in quaternary compounds, result from the complication in composition produced by such a body as nitrogen, as yet so problematical in its nature, and of whose combinations, even binary, so little is known.

I have, therefore, thought proper to suspend the labor which I had undertaken, and to leave the field open to those who, not deterred by the difficulties, would be willing to devote themselves to these researches. Moreover, I have thought that it would be useful to publish the observations which I have made upon this subject, as a guide to future investigations.

The action of Chlorine upon Strychnia.

When a current of chlorine gas is passed through water, holding in suspension finely powdered strychnia, it will be perceived that the temperature is elevated, that the strychnia

is attacked, and that a very white flocculent matter swims upon the surface in the form of froth.

If the action of the chlorine be suspended before all the strychnia is decomposed, and if the flocculent matter be separated by the filter, the undecomposed strychnia will be found in the liquid dissolved in hydrochloric acid.

If we continue to pass chlorine through this solution of hydrochlorate of strychnia, the dissolved alkali will still be attacked as when free, and new portions of flocculent matter be formed as long as there remains any trace of strychnia in the liquor. If the liquid be now examined, it will be found that it is but little colored, except under circumstances to be hereafter pointed out, but that it has become very acid; saturated with ammonia, it lets fall some white flocculi produced by the matter before noticed, which is no longer strychnia, but a substance formed at its expense; finally, on evaporating the liquid we obtain the hydrochlorate of ammonia containing only a trace of organic matter.

If, in place of passing chlorine through water holding strychnia in suspension, we act upon a salt of strychnia in solution, the white matter is formed immediately, and the bubbles of the gas are seen surrounded with a white shining envelope, a white froth covering the whole surface of the liquid; this effect continues as long as any trace of strychnia remains in the liquid.

On the passage of the first bubbles, the liquid becomes acid; this acidity is owing to the liberation of the acid which had been saturated by the strychnia, and likewise to the formation of hydrochloric acid immediately on the reaction taking place.

When this liquid ceases to form flocculi, it retains in solution but a small quantity of organic matter, composed almost entirely of this flocculent substance, which, although not soluble by itself, becomes slightly so, by the aid of the free acids, contained in the liquid.

A phenomenon which often occurs during the action of the chlorine upon strychnia, is the appearance of a red color in

the liquid. But this, which is not constant, is foreign to the strychnia, and is due to a little brucia which accompanies the strychnia in the *Faba St. Ignatii* and the nux vomica, and from which it is separated with difficulty. Chlorine may, therefore, be regarded as a proper re-agent to detect the presence of brucia in strychnia.

But, what is of the highest importance in toxicological investigations, chlorine is itself a re-agent for the detection of strychnia; a re-agent the more important, as no other has as yet been discovered for it; while, at the same time, that, by means of chlorine, we can manifest its presence, we can also act on quantities hardly sensible. We will return again to this subject, which requires still further details, and, in the meanwhile, examine the white matter produced by the action of chlorine on strychnia. To obtain this pure and free from strychnia, it is proper to form it in a diluted solution, and to take for this purpose a pure salt of strychnia and dissolve it in one hundred parts of water; the matter should be washed first in cold water, afterwards in boiling water, to deprive it of every trace of free acid; finally, it should be dissolved in sulphuric ether. By spontaneous evaporation, it crystallizes in slightly lamellar plates. This solubility in ether will serve to distinguish it from the strychnia from which it is produced, and likewise to separate these two substances, strychnia being scarcely soluble in the ether. Now to consider the characters which it presents: it is white, and even of a shining white, while moist; by drying it becomes grayish; it is scarcely soluble in water; its taste is bitter but infinitely less so than that of strychnia; it is somewhat aromatic; it dissolves very well in alcohol, either weak or rectified; it crystallizes in extremely fine and almost microscopic needles. Not only it does not saturate acids, but it does not appear to be able to combine with them; nevertheless they promote its solubility. When heated, this matter does not melt; at 150° C. it begins to blacken, and becomes charred, giving off vapors of hydrochloric acid. Some experiments, which it appears to me to

be useless to detail here, have proved that the hydrochloric acid does not exist ready formed in this matter, but that the chlorine enters into the compound as one of its elements. I will now pass to its elementary analysis.

Few analyses have employed me as much as that of this matter. I have repeated it a number of times. I desired to procure by direct experiment simple, or, at least, rational information, which would afford an exact theory of the action of chlorine upon strychnia, and perhaps upon the other organic bases; unfortunately, I have obtained nothing sufficiently satisfactory in this point of view. I will proceed, however, to give the composition as derived from such of my analyses, as from their agreement, have inspired me with most confidence:

Carbon,	50.16
Hydrogen,	4.74
Nitrogen,	5.19
Chlorine,	24.50
Oxygen,	15.41
	100.00

The following are the bases upon which these results have been calculated:

For the carbon and hydrogen,

Matter used,	0.318
Carbonic acid,	0.557
Water,	0.125

For the nitrogen,

Matter used,	0.173
Nitrogen gas obtained,	30 cubic centilitres.
Temperature,	4°
Pressure,	$0^{m}.762$

For the chlorine,

Matter used,	0.305
Chloride of silver,	0.303

It is almost useless to endeavor to represent this composition by an atomic formula, for it has not been possible to form with this matter any definite combinations and consequently to fix its atomic weight.

The following formula indicates only the relations of atoms to each other:

Carbon,	45
Hydrogen,	26
Nitrogen,	2
Chlorine,	4
Oxygen,	5*

But we may conclude from the elementary analysis which has been stated, that the matter obtained by the action of chlorine upon strychnia is the product of reaction, and not a chloride of strychnia; for upon substracting the chlorine, the remaining elements are not in such proportion as to form strychnia. The quantity of the carbon is too small, and of the oxygen too great. As to the hydrogen, the quantity is nearly equal in each; but as hydrogen has necessarily been abstracted by the chlorine to form hydrochloric acid, it is necessary that the hydrogen should re-enter under the form of water. This subject requires still further research.

The action of chlorine upon strychnia, viewed as a means of investigation in the research for that substance, appears to me, as I have before said, to deserve consideration. The sensibility of chlorine as a re-agent for strychnia, is well marked, and suffices to discover even a trace. Hardly has a bubble of chlorine reached the solution of strychnia (for the

* This is evidently a miscalculation. The atomic weights of hydrogen and oxygen being taken at one and eight respectively, would give ten atoms of oxygen.

strychnia is always in solution in acid liquors, or those rendered such,) when a white cloud appears on the passing of the bubble, and spreads through the liquid. Among organic substances, I am acquainted with only albumen and gelatin which produce like phenomena; but the precipitate formed from strychnia is soluble in alcohol and ether, while the precipitates formed by chlorine in a solution of albumen or gelatin are insoluble in alcohol and ether. If strychnia is precipitated by chlorine from a liquid containing albumen or gelatin, we may separate these precipitates by means of alcohol.

The action of Chlorine upon Brucia.

As a first experiment, I passed a current of pure chlorine gas through a neutral solution of hydrochlorate of brucia. In acting at first on a soluble salt of brucia, I had in view to ascertain whether analogous phenomena to those observed in treating a salt of strychnia would be manifested, and whether there would be a formation of insoluble matter immediately on the passage of the first bubbles of the gas, a fact which I could not so well ascertain by using brucia in powder, simply suspended in distilled water. The liquid did not become cloudy, but from being without color, it became first yellow, then orange, afterwards a clear red, and finally blood-red. From this point the color diminished, passing through the same tints. At the point where it had become only yellow, flocculi were formed in the liquor and continued to be produced for three days, the operation being carried on during that time. After this interval, the filtered liquid gave but slight flocculi by chlorine, it had become very acid.

In a second operation, pure chlorine gas was passed through distilled water, holding powdered brucia in suspension, and the brucia was dissolved. As long as any brucia remained undissolved, the liquid exhibited no acidity, although hydrochloric acid was formed; for as soon as the acid was produced at the expense of one portion of the brucia, it was neutralized by the free brucia. At the moment when all the brucia was

dissolved, the liquor was neutral and of a yellow color; but it soon became acid and of a rose color, then red, following the course we have before noticed in treating the hydrochlorate of brucia with chlorine; finally, yellow flocculi began to appear, and when they ceased to form, the operation was stopped. These flocculi collected, and washed, first with cold, afterwards with boiling water, contracted, and were reduced to a very small volume. The liquid, from which they were separated, when saturated by ammonia, gave some flocculi, the weight of which was insignificant, and the color vinous red. By evaporation, much hydrochlorate of ammonia was obtained, of a dirty red color, but it was not possible to separate this coloring matter from the hydrochlorate of ammonia by which it was impregnated.

In a third experiment, I stopped the process at the moment when the liquid appeared to have attained its maximum of coloration. Saturated with ammonia, a flocculent matter was separated, which, on being washed and dried, had the appearance of a resin. This matter was of a clear white, insoluble in water, soluble in alcohol, but not crystallizable; its taste was bitter; nevertheless it did not contain brucia, for administered to a rabbit in the dose of two decigrammes, it produced no effect upon the animal.

The flocculent matter which had separated spontaneously from the solution of brucia, would not crystallize any more than that obtained by ammonia, nor would it sublime without decomposition; in short, it exhibited no property by which it could be considered as a body chemically pure or susceptible of being purified; I was, therefore, obliged to abandon it; it would have only been loss of time to submit the matter to an elementary analysis. However, it is evident that the chlorine does not combine directly with the brucia, but that it acts strongly upon its elements, converting it into a resinous matter, by separating a part of hydrogen, with which the chlorine combines to form hydrochloric acid.

Action of Chlorine upon Quinia.

Quinia, in fine powder, was suspended in distilled water, and a current of chlorine passed through the mixture; the quinia was quickly dissolved, communicating to the liquor a color at first rose, then violet red, and finally deep red. On continuing the disengagement of the chlorine, the color diminished in intensity, a reddish viscous matter was precipitated, which adhered to the sides of the vessel, but by exposure to the air became friable. To purify this substance from the free hydrochloric acid which it contained, interposed between its particles, I boiled it several times in water. This substance I will examine presently.

The liquor from which the viscous matter had been separated, was strongly acid; saturated with ammonia, yellow flocculi were separated; these, by desiccation, became brown, presenting a matter very similar to that which had separated spontaneously. Lest it should retain some quinia, this matter was dissolved in water acidulated with sulphuric acid; it dissolved by the aid of heat, but was deposited on cooling. If it contained any quinia, this would remain dissolved in the acid liquor.

Finally, the ammoniated liquor, from which the brown resinous matter had been obtained, evaporated by a salt water bath, yielded much hydrochlorate of ammonia colored red by the same matter, a part of which resinous substance separated on re-dissolving the salt.

Sulphate of quinia in fine powder, suspended in water, was submitted to the action of chlorine; it soon dissolved. The liquor became yellow, red, and, finally, green; at this time grayish flocculi began to precipitate; ammonia poured into the liquid produced but a very slight precipitate. In another experiment, which had been carried on to the production of the red color, ammonia gave an abundant precipitate, having all the characters of the resinoid substance obtained by treating quinia itself with chlorine. It appears from this, that the

sulphuric acid opposes the precipitation of the resinoid matter, and that this, from being retained in solution, continues to be acted on by the chlorine, and undergoes a greater alteration, characterized by the green color which is produced.

Finally, quinia in powder, exposed to the action of pure, dry chlorine gas, becomes strongly impregnated with the gas, and takes a green color. Treated with water, a small portion is dissolved, and the water becomes acid from containing free hydrochloric acid. Treated with boiling water, a part only is dissolved; a brown matter remaining like that obtained from quinia by the action of chlorine and water.

The resinoid matter obtained under all these circumstances is identical. It presents the following characters: a brown color, a bitter taste, but less strong than that of quinia; it is scarcely soluble in cold water, and a little more in boiling water. Acid liquids dissolve it readily by means of heat, but the greater part separates on cooling; it is soluble both in weak and absolute alcohol. Dissolved in strong alcohol, and set aside to evaporate spontaneously, it separates in the form of a granular powder. These granules, viewed by a microscope, appear to be four-sided prisms.

The action of Chlorine upon Cinchonia.

Chlorine acts upon cinchonia with less energy than upon quinia. This does not result from the resistance which the crystalline state of cinchonia offers, for the sulphate of cinchonia is also less strongly attacked than the sulphate of quinia. The color of the solution charged with chlorine, is of a less deep red; it does not pass to a green, but the flocculent matter which is formed and separated does not appear to differ much from that produced from quinia. Dissolved in alcohol, it affords, by spontaneous evaporation, a brick-red matter having somewhat of a crystalline aspect.

The action of Chlorine upon Morphia.

Morphia suspended in water, and submitted to the action of chlorine, became of an orange yellow, and then clear red,

at which moment it was entirely dissolved. Continuing to pass the chlorine, the red color diminished in intensity and passed to a yellow; during which a flocculent matter was precipitated. This precipitate, collected upon a filter and washed until it ceased to be acid, was treated with alcohol. A part only was dissolved; a black, insoluble, tasteless matter, a sort of apothegm, being left behind. The dissolved matter did not crystallize on the evaporation of the alcohol, but was left in the form of a resinous matter, of a reddish-brown color and a bitter taste.

The acid liquor, from which the resinoid matter had been obtained, on being saturated with ammonia, gave but slight flocculi, which re-dissolved by agitation.

Morphia, then, of all the alkaloid substances which we have submitted to the action of chlorine, is the most promptly attacked; it alone deposits with, the resinoid matter, a carbonaceous substance, which appears the final termination to the destruction of very carbonaceous vegetable matter.

The action of Chlorine upon Narcotina.

Narcotina, suspended in water and treated by chlorine, receives at first a flesh color; this color deepens more and more, until it becomes of a reddish brown; the narcotina is then entirely dissolved; at this time it begins to deposit a brown flocculent matter and the liquor becomes green. This flocculent matter washed in boiling water becomes green; the washings are acid. Continuing to wash the green matter until it is no longer acid, it becomes as black as coal, friable, infusible, and insoluble in alcohol. It was again an apothegm which remained.

The water of the washings, saturated by ammonia, threw down a small quantity of resinoid matter of a beautiful green.

Narcotina, submitted to the action of chlorine gas, becomes rapidly of a reddish brown color. The mass treated with water is partly dissolved and colors the liquid green;

there remains a greenish black insoluble matter, similar to that of which we have already spoken.

Here terminate my experiments relative to the action of chlorine upon organic salifiable bases. However imperfect they may be, we may nevertheless draw from them the following conclusions:

1. Chlorine does not combine with the organic salifiable bases.

2. It acts by decomposing them, withdrawing hydrogen to form hydrochloric acid.

3. The result of this action is the formation of neuter substances, incapable of saturating acids, but little soluble in water, soluble in alcohol, and presenting a crystalline appearance only when obtained from quinia and cinchonia.

4. Strychnia is the substance which gives the most positive results; it affords a white shining matter, soluble in alcohol and ether. This matter is composed of five elements according to the analysis before reported, compounded as follows:

Carbon,	50.16	45 atoms.
Hydrogen,	4.74	26 "
Nitrogen,	5.19	2 "
Chlorine,	24.50	4 "
Oxygen,	15.41	5 "

5. The extreme sensibility of chlorine as a re-agent for strychnia, (a re-agent which had not as yet been discovered,) becomes a precious aid to investigation, in toxicological researches, relative to a substance so eminently poisonous.

EXTRACT FROM THE MINUTES OF THE PHILADELPHIA COLLEGE OF PHARMACY.

Stated meeting held March 26th, 1838.

HENRY TROTH, Esq., Vice President, in the Chair.

The minutes of the stated meeting in November last were read and adopted.

The minutes of the Board of Trustees were read, from which the College is informed of the election to associate membership of the following gentlemen: NATHAN WOODBRIDGE THATCHER, THOMAS W. HARRIS, and THOMAS W. M'KENSEE.

Also, that the following candidates for graduation in the College, having passed an examination before the Professors and Committee of Examination, and submitted Theses on the subjects enumerated below, were duly declared by the Board to be "Graduates of the Philadelphia College of Pharmacy:"

ROBERT B. POTTS,	*Capsicum Annuum.*
THOMAS W. HARRIS,	*Analysis of Mineral Waters,*
HENRY W. WORTHINGTON,	*Veratrum Viride.*
RICHARD RUSHTON,	*Asarum Canadense.*
A. DICKINSON WOODRUFF,	*Kino.*
HENRY BROOKS,	*Ipomœa Jalapa.*
WILLIAM EDWIN KNIGHT,	*Chrysanthemum Parthenium.*
CHARLES WELLS SIMMONS,	*Eupatorium Perfoliatum.*
CLAUDIUS B. LINN,	*Aralia Nudicaulis.*

The Annual Reports of the Treasurer, and of the Hall Committee, were received from the Board of Trustees and read.

The Report from the Committee of Publication was read and accepted.

This being the evening on which is held the Annual Election, the following gentlemen were duly elected officers of the College, Trustees, &c., for the ensuing year:

President.

DANIEL B. SMITH.

1*st. Vice President*—HENRY TROTH.

2*d. Vice President*—DR. G. B. WOOD.

Secretary—CHARLES ELLIS.

Corresponding Secretary—ELIAS DURAND.

Treasurer—EDWARD B. GARRIGUES.

Trustees.

WARDER MORRIS,	JOS. C. TURNPENNY,
RICHARD M. REEVE,	DILLWYN PARRISH,
E. C. MARSHALL,	THOMAS H. POWERS,
EDWARD ROBERTS,	A. S. ROBERTS.

Publishing Committee.

D. B. SMITH,	DR. BACHE,
CHARLES ELLIS,	DR. WOOD,
DR. CARSON,	DILLWYN PARRISH,
ELIAS DURAND,	WM. HODGSON, SR.,
J. C. ALLEN,	DR. BRIDGES.

On motion adjourned.

MISCELLANY.

Observations on the Employment of Carbonic Acid Gas as a Therapeutic Agent, by Wm. R. Fisher, M. D., Professor of Chemistry and Pharmacy in the University of Maryland.—In the twenty-third number of the first volume of the "American Medical Intelligencer," (pp. 415 to 417,) occurs an abstract from the memoir of Dr. Furnari, relative to the employment of carbonic acid gas in medicine. In this abstract the use of fumigations of this gas to various diseased tissues is spoken of, and the intravaginal employment of it in amenorrhœa and other uterine diseases warmly recommended. It is not my purpose to comment either upon the pathological considerations which have induced this practice, or to offer any views as to its efficacy; but an apprehension lest some injury may result from the application of the gas to tissues of such delicacy and sensbility, unless the administration be attended with proper precautions, induces me to ask the attention of the profession of this country to the following considerations. The danger, which I apprehend, may arise from the following paragraph:—"These fumigations are prepared, in cases of uterine pains, by receiving into the vagina the free extremity of a gum elastic canula, surmounted with a nipple-like end, through which is passed carbonic acid gas, which is disengaged from carbonate of lime by means of dilute sulphuric or hydrochloric acid." . . . . . "Nothing is more simple, less expensive, and more easy to practise than this operation."

It is true enough that there is no simpler operation in chemistry than the disengagement of carbonic acid gas, and the subsequent distribution of it in any direction by means of an elastic tube; but did the author bear in mind that nascent gases, especially those resulting from the action of an acid, always carry over with them large quantities of the acid in the form of vapor, intimately associated with every bubble that rises? Is there not room for apprehension, that the gas fresh from the materials, to the reaction of which its escape is due, will carry over a sufficient quantity of the mineral acid to act, if not as an escharotic, at least as a powerful rubefacient or stimulant to the delicate tissues for whose advantage it is directed to be employed?

So great have been my apprehensions upon this subject that I have felt it my duty to caution the profession against this effect immediately

upon the perusal of the paragraph quoted; and I am induced at the same time to suggest a means by which the efficacy may be tested, without exposing the patient to the risk of injury from the direct action of the strong mineral acids.

It is essential that the gas employed for this purpose should be perfectly free from the sulphuric or hydrochloric acids, by means of which it is liberated from its solid compound; and this degree of purity can only be accomplished by washing the gas in water. The employment of an apparatus for this purpose may be somewhat inconvenient in the country; but it would be far better to abstain from the use of the gas altogether than to incur the risk of irritation, or even inflammation, which might ensue from its employment in an unwashed state. I shall endeavor to arrange some simple apparatus for this purpose, in which if I should be successful I will forward you a drawing and description of it. At present, the only means which suggests itself, is to employ for the purpose Woulfe's bottles, connected with each other by a bent tube. In the one, the carbonate of lime is to be placed; in the other, water enough to cover the end of the bent tube which connects the bottles. The elastic tube should then be connected with the open mouth of the second bottle, in which the water is contained; and the whole apparatus being prepared, the dilute acid may be poured into the first bottle containing the carbonate of lime; the mouth of the bottle being immediately closed. Effervescence will immediately take place, and the gas proceeding through the bent tube will be compelled to pass through the water in the second bottle, be deprived of all contamination, and forced out of the elastic tube by the pressure from behind, arising from the constantly accumulating pressure in the bottle wherein it is disengaged.

The chief difficulty attending the use of this would be obtaining the Woulfe's bottles; in all other respects no improvement or simplification would be required. The patient could readily perform all the manipulations herself, after having been once instructed in the proper proportions of the materials to be employed.

A word or two as regards the acid to be used. Hydrochloric acid is decidedly preferable to sulphuric acid, on account of its yielding a soluble salt with lime, which may be removed from the generator with far greater ease than the heavy, adhesive, insoluble sulphate; and on this account it should always be employed. The quantity of carbonic acid yielded by limestone or chalk, if of tolerable purity, is always the same, whatever be the acid employed; and I annex the quantity by weight which is required to produce a gallon of carbonic acid gas at the average temperature of 60° F.; should the temperature range above 60° F., the volume of gas will be somewhat increased. The paper from which I quote the above paragraphs, gives no idea of the quantity of gas required; but it is decidedly an advantage to the correct observer to be acquainted with the

exact amount employed, as he may thereby be enabled not only to form a much more correct estimate of its influence, but to increase or diminish the quantity in definite proportions as the indication may require.

In large cities, where carbonated waters are manufactured on a large scale, the most easy plan of all to obtain the use of this new therapeutic agent, and in a perfectly pure condition, is to affix the elastic tube to a bottle of soda water, as it is called, and having introduced the canula into the vagina, to compel the gas to pass over by immersing the bottle in a basin of boiling water, by which means a quantity of gas would be obtained equal to about five times the volume of the soda water employed.

The exact quantity of pure carbonate of lime required to furnish a gallon of carbonic acid, is 242.86 grains, near enough to half an ounce to allow that weight to be substituted for it. To decompose this quantity, a fluid ounce of common muriatic acid will be sufficient. By adopting these proportions the gas may be administered in definite doses, as it were, and its effects be much more satisfactorily observed and determined.

Am. Med. Lib. and Intelligencer, Baltimore, April 2d, 1838.

Medical properties of Codeia.—With regard to this remedy we have the following statement of Dr. Miranda, of Havana: "Desirous for a long time of possessing an efficacious remedy in gastritis, I had recourse to a number of remedies recognised as *anti-nervous*, if I may be permitted thus to express myself; thus I employed the martial preparations, which have been vaunted for this kind of affections of the stomach. I have never obtained by these means but imperfect cures, which, according to me, resulted only in metastasis, and could not justify the pretended efficacy of these remedies.

"I sought in vain to study the temperament of patients, to know if, under circumstances nearly identical, I could count upon happy effects, either from anti-spasmodics, or from martial preparations; but the result always left me in uncertainty as to the true effect produced by the agent employed, and I remained little satisfied with my medication.

"An intelligent gentleman, one of the most so upon the island, who has honored me with his friendship, M. Lobé, informed me of codeia discovered by M. Robiquet, and indicated, at the same time, the properties that had been attributed to it in France, principally by M. Barbice d'Amiens. I made trial of it, and to be convinced by my own experience of the degree of energy and efficacy of this new product in great nervous irritation of the mucous membrane, which I regard as the seat of this sort of affections, I had recourse to the syrup of codeia,* which I employed alone. I can

* See the formula in the Ninth volume of this Journal, p. 352.

now cite eleven cures well established in the cases of nine young men, and two females, one forty years old, the other sixty.

"I commenced by administering only a drachm of the syrup, and this was given morning and evening; no other precautions were taken besides enjoining a moderate diet and some hygienic measures. I have augmented gradually the dose of the syrup until I have given an ounce in the twenty-four hours. The first case in which I had occasion to employ it, was that of a young man, for two years laboring under a gastritis, which had resisted all the remedies employed. He suffered much, and his condition was becoming most alarming; he had become so weak and emaciated as to present the appearance of phthisis. The efficacy of the remedy was such, that after a month's exhibition the gastritis had entirely disappeared, and yet the maximum quantity of syrup taken in the twenty-four hours did not exceed six drachms. In spite of so satisfactory a result, I did not lay aside distrust, and employed the medicine with the same reserve in a second case, and with the same success, for the patient was cured in twenty-four days.

"The other cures, obtained by the same treatment, were neither less certain or less conclusive, so that I regard the discovery of codeia as a true blessing to humanity, especially in a climate like ours, where gastritis is so common."—*Journ. de Pharmacie.*

Action of Iron at a high temperature upon Benzoic acid; production of Benzin.—M. Felix D'Arcet passed the vapor of benzoic acid over red hot iron; by this he obtained a yellowish fluid oil which had an empyreumatic odor mixed with that of bitter almonds. This oil, was rectified on a salt water bath, and left a pitchy residue; the distilled fluid was very fluid and colorless; it had a peculiar odor, boiled at 185° F., and congealed at 21°. By decomposition with oxide of copper it was found to consist of

Hydrogen,	7.935
Carbon,	92.065
	100.000

This liquid is therefore benzin, composed of six equivalents of hydrogen and twelve equivalents of carbon; its production is attended with the formation of carbonic acid, and supposing hydrated benzoic acid to have been used, the action must have been thus:

	Hydrogen,		Carbon,		Oxygen,
Benzoic acid,	6		14		4
Carbonic acid separated,			2	+	4
Benzin obtained,	6	+	12		

When the temperature is too high, oxide of carbon is obtained; but when it is merely low red, then only carbonic acid is produced.

Benzin may also be obtained according to M. D'Arcet, by distilling a mixture of benzoic acid and arsenious acid.

M. F. D'Arcet, also passed the vapor of camphor over iron heated to redness: he obtained in the receiver a very fluid, yellowish, oleaginous liquor. When subjected to the heat of a salt water bath, no portion of it came over; but when the temperature was raised to about 293°, a slightly yellow colored liquid distilled; it was lighter than water, had a peculiar aromatic odor, not at all resembling that of camphor, if the operation was slowly conducted.

Analysed by means of oxide of copper, it gave

Hydrogen,	7.65
Carbon,	92.35
	100.

This product therefore, like the preceding, is equivalent to a compound of twelve hydrogen + six carbon, and therefore resembles benzin in composition, but its properties are very different, for it boils at 284° F., instead of 185°. When the operation is conducted at a high temperature, then, beside the above mentioned product, naphthalin is also obtained.

Ann. de Chim. lxvi., *and Lond. and Ed. Phil. Mag.*, May, 1838.

Experiments on Camphor.—MM. Dumas and Peligot have made the following statements as the results of their experiments on common camphor: Neutral and oxygenated organic bodies, when their vapor contains half a volume of oxygen, approximate alcohol in general in the nature of their reactions. This is at any rate what happens with the spirit of wood, oil of potatoes, ethal and pyroacetic spirit. This generalization struck us long since, and we have subjected common camphor, which is so constituted, to the action of some bodies which would allow of procuring from them decisive products, admitting that camphor would act like alcohol. We shall limit ourselves to stating here, that common camphor, treated with anhydrous phosphoric acid, furnishes a liquid volatile oily carburetted hydrogen, composed of $C^{40}H^{28}$; this then comes from camphor, as if the body being formed of $C^{40}H^{28},H^4O^2$, should lose its water under the influence of the phosphoric acid. On acting upon camphor by sulphuric acid, a light volatile oil is also obtained. It appeared to us to be formed of the carburetted hydrogen preceding, and camphor, in variable proportions. By rectification with anhydrous phosphoric acid, it resolves always into the carburetted hydrogen, $C^{40}H^{28}$, already mentioned.—*L'Institut. and Lond. and Ed. Phil. Mag.*

On the mode of preparing and the most convenient form of the Hydrated Sesquioxide of Iron, to be used as an Antidote for Arsenious Acid, by MM. BUNSEN *and* BERTHOLD.—The best process to obtain this body in a pure state, consists in peroxiditing by means of nitric acid and heat, a solution of pure sulphate of iron, precipitating the solution by ammonia, and washing the hydrated sesquioxide by decantation; it should not be forgotten that the solution should be completed before the acid is added, and the nitric acid added by small portions at a time; otherwise a considerable quantity of the neutral sulphate of the sesquioxide is separated under the form of a yellow powder, which is but slightly soluble. The chloride of iron is less suitable to the preparation of this substance,on account of the liability when precipitating by ammonia of obtaining a mixture with a large quantity of basic chloride of iron. Lest the precipitated sesquioxide should lose its hydratic water and thus diminish its feeble state of aggregation, it is not to be filtered, but having been allowed to settle for several days and superincumbent liquid poured off, it is to be preserved in closed vessels.

However simple the process pointed out for the preparation of this antidote, there will not be wanting persons to propose modifications, and some of them so little suitable that we consider it to be useful to add some remarks on this subject. There is first of all a practice which should be rejected; this is, to employ any other alkali than ammonia for the precipitation of the hydrated sesquioxide of iron: in fact, the least quantity of alkali retained in the precipitate, would give rise to the formation of an arsenite which would completely prevent its precipitation by the sesquioxide; for this substance can completely overcome the affinity of the ammonia for the arsenious acid, but not that of potassa or soda for the same acid. It is necessary also to renounce the idea of being able, when employing a salt of the sesquioxide mixed with copper, to purify the precipitate obtained, from the copper, by means of an excess of ammonia. This purification is, as we know, always incomplete. But it is altogether inconceivable that any one depending upon some very inexact experiments upon animals, should recommend the preservation and use of the antidote in a dry state, since numerous experiments already made, and in agreement with our own, lead to the result, that the action of the sesquioxide of iron is of no effect, and that of the dry hydrate incomplete, as we would *a priori* conclude, since the dry hydrate never completely precipitates the arsenious acid in the cold. This recommendation to dry the product, appears to be dictated by the erroneous opinion that the hydrate is altered and loses its efficacy by long preservation. We can disprove this with certainty, since we have found that a precipitated hydrate of the sesquioxide, resulting from a carbonate of iron enclosed in a mass of travertin (carbonate of lime) which had been deposited under water, had preserved all its efficacy, and the condition of the mass of tra-

vertin in question demonstrated that many ages had passed since its deposit. This precipitate of the sesquioxide owes its action only to its gelatinous hydrated state, which will be perfectly preserved under the stratum of water from which it has been deposited.—*Journ. de Pharmacie.*

Stearoptene of Turpentine, by R. Brandes.—Crystals have frequently been observed in the rectified essence of turpentine; the researches of MM. Buchner, Hafner, Boissenot and Persoz, Geiger, Blanchet and Sell, have demonstrated that they constituted the stearoptene of turpentine. Moreover, other chemists, as MM. Sangiorgio, Lecaner, Serbat, Henry, &c., have also obtained an acid resembling succinic acid. A short time since, I observed some crystals in the essence of turpentine recently rectified. In order to collect them, I placed them upon a filter; after having decanted the oil, I washed and dried them. But their quantity was small and did not amount to 15 grains! they were transparent with a vitreous hue; some of them were unpolished; they were in part isolated, in part grouped in clusters, and under the form of stars; their size was found one-half to three lines in length, and one-fourth of a line in breadth; they formed quadrilateral prisms; by means of a glass it was perceived that the base was a rhomboid, but of which the angles did not differ sensibly from the form of right angles. The free extremity of the prism was terminated by a dihedral summit; the crystals sunk to the bottom of water.

Heated in small quantity in a small globe, they soon sublimed into a fine filamentous mass and into capillary crystals, entirely white, some of which were more than an inch in length. When a greater quantity of crystals were taken, a portion became liquid during sublimation, and solidified upon cooling into a small cake, which heated anew again became fluid, and then sublimed without residue by the continued action of heat. The crystals completely dissolved in *a large quantity of water* by the aid of heat! they were equally soluble in *alcohol* and *ether*. The alcoholic solution may be diluted with several times its volume of water without becoming turbid. The essence of turpentine, when cold, did not dissolve them as decidedly as alcohol or ether, but when heated gave place to complete solution, which did not become troubled upon cooling or agitation with water. *The solutions of caustic potassa and of ammonia*, when cold, do not perceptibly dissolve them; by heat the dissolution is complete, but does not become troubled when the alkali is neutralized, so that these bodies do not act but by virtue of their water of solution. Tried by test paper, the watery solution of the crystals appeared neutral.

If concentrated and rectified sulphuric acid be poured upon a small quantity of these crystals, a deep red liquor is produced, which, as is also stated by Buchner and Hafner, exhales an odor resembling artificial musk; and the odor of oil of fennel is equally observed. Water pro-

duces a white cloudiness in the red solution, and by little and little separates from it yellowish white flocculi.

Chlorohydric acid when cold has no sensible action, but in proportion as it is heated there is produced a white cloud; by ebullition, the liquid bubbles up with noise: a strong smell of petroleum is developed. After cooling, the liquid, which was of a milky white, becomes clear, and upon its surface floats a yellowish oil which gradually becomes solid.

Acetic acid dissolves the crystals with facility when cold; the solution is not troubled by water; ebullition has no further effect.

These crystals are slightly soluble in cold *nitric acid*: but in proportion as they are heated, they are decomposed: there is formed in the acid, a milky white cloud, and upon the surface is to be observed drops of a yellow oil; and a well marked odor is then developed, similar to that produced by a mixture of the oil of fennel, of anise, and naptha. The elevation of temperature gives place to a more vivid reaction; the acid is colored yellow, nitrous gas is disengaged, and a more camphoraceous odor is developed. The small quantity of crystals obtained did not permit any more experiments. The accordance of the properties described with those indicated by M. Buchner, shows clearly that it was stearoptene of turpentine, and serves to confirm anterior observations. A. G. V.

Journ. de Pharmacie.

Tabl. 32

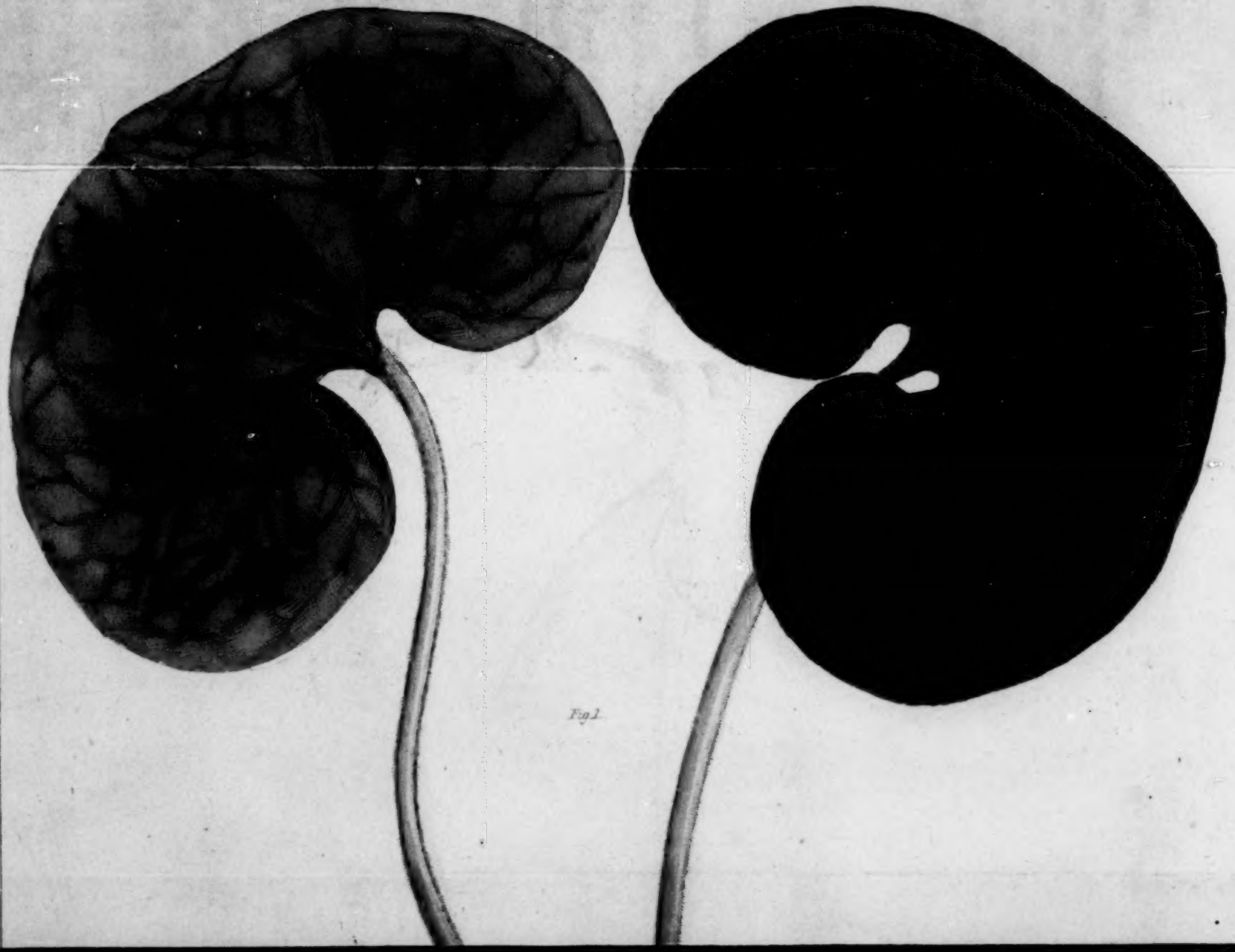
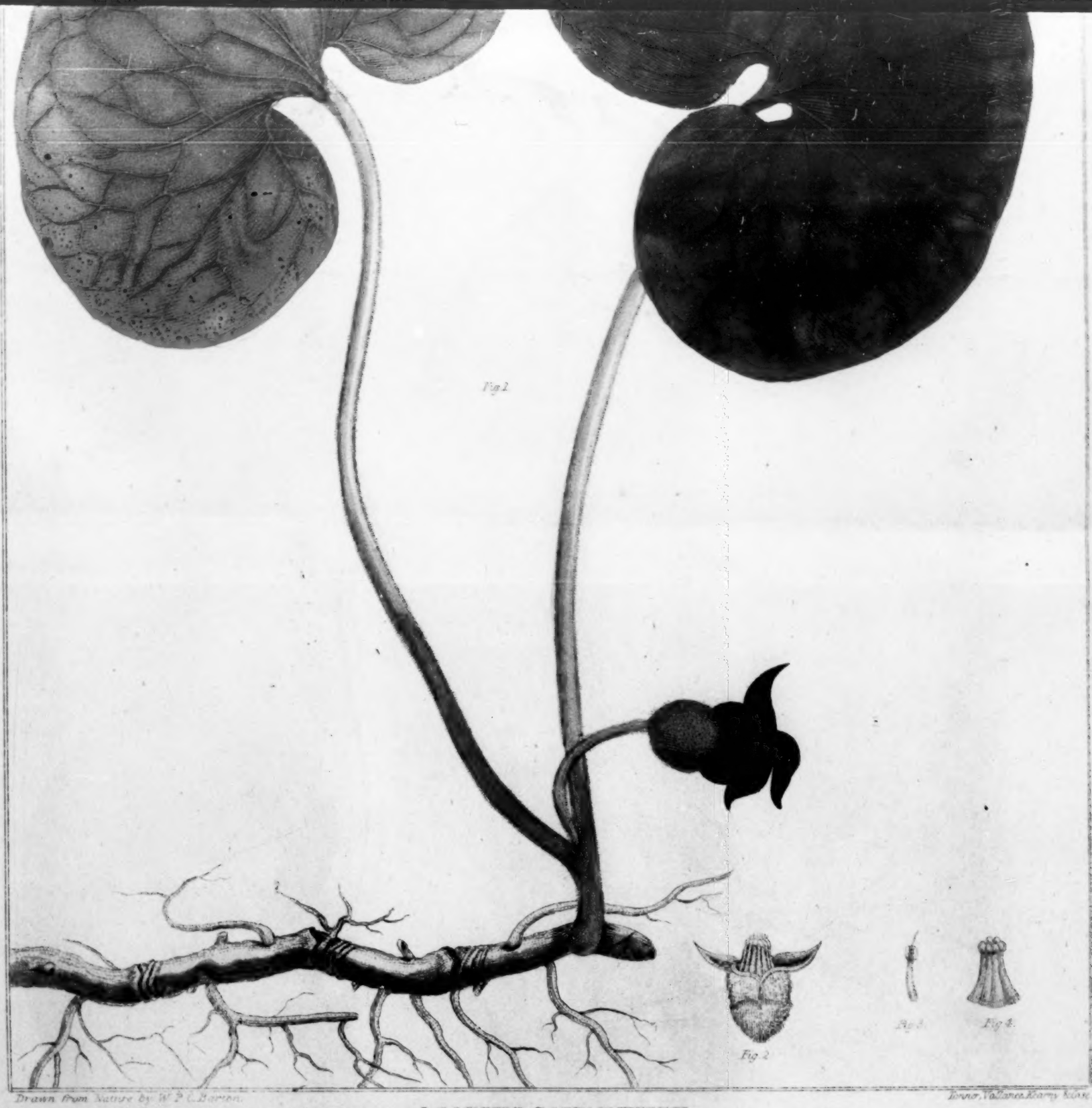


Fig 1



Drawn from Nature by W. P. C. Barton.

Lowes. Vallance. Harry Sculp.

ASARUM CANADENSE.

(Wild Ginger.)